CONNECTICUT RIVER FLOOD CONTROL PROJECT

HARTFORD, CONN.

PARK RIVER, CONNECTICUT

SPECIFICATIONS

FOR THE CONSTRUCTION OF

BUSHNELL PARK PUMPING STATION

ITEM Ht. 12 - CONTRACT

NEW ENGLAND DIVISION- CORPS OF ENGINEERS- WAR DEPARTMENT

BOSTON, MASSACHUSETTS

MAY 1947

TP15-11. PIPE COVERING. - All hot water piping shall be insulated with 1-inch, wool-felt, sectional covering, asbestos lined, with 8-ounce canvas jacket, sewed in place. All covering shall be neatly finished and free from cracks or irregularities. Fittings and valves in covered lines shall be covered with a 1-inch thickness of asbestos plastic and shall be canvas-jacketed.

TP15-12. SUPPORTS AND FASTENINGS. - a. All horizontal piping shall be supported on approved type pipe hangers and brackets designed to allow for expansion of the piping and to permit vertical adjustment.

b. All overhead cast-iron soil, waste, and drainage lines shall have supports not more than 5 feet apart. Vertical lines shall be adequately supported at each floor by means of approved clamp type supports. All other pipe shall have supports not more than 10 feet apart for pipe larger than 1-1/2-inch, and 8 feet apart for pipe 1-1/2-inch and smaller and at lesser intervals wherever necessary to prevent sagging.

TP15-13. FIXTURE CONNECTIONS. - a. All equipment and fixtures shall be carefully assembled, installed where indicated on the drawings, and connected to the required plumbing outlets, so that the equipment will be ready for operation when completed.

b. The connection between earthenware or any fixtures and flanges on soil pipe shall be made absolutely gas- and watertight with a closet-setting compound of gaskets.

TP15-14. PLUMBING FIXTURES, FITTINGS, AND TRIMMINGS. - a. General. - The Contractor shall install all plumbing fixtures as specified herein and as noted on the drawings. All manufactured items shall be furnished in strict accordance with this specification. All materials shall be new and free from defects.

b. Materials. - (1) Vitreous china. - All vitreous fixtures shall be of "first quality" white vitreous china conforming to Federal Specification WW-P-541a.

(2) Cast-iron enameled ware shall comply with the applicable provisions of Federal Specification WW-P-541a.

c. Fixture fittings. - Except where otherwise specified under the separate fixture items, all fixture supply fittings shall be made of chromium plated brass. Valve seats shall be renewable. Handles may be either the cross or the lever type. Chromium plated supply pipes shall be furnished with the supply fittings. Combination or double type faucets for lavatories may be of the exposed body or concealed body pattern. The exposed body patterns may be furnished in a single casting or as a factory-assembled unit with separate faucets and connecting pipes. All drain plugs shall be made entirely of chromium plated brass,

and shall have brass tailpieces, approximately 4 inches long with slip joint connections. Lavatory drain plugs shall have cross bars, overflow openings, 1-1/4-inch diameter tailpieces, and minimum 1-inch openings for stoppers. Each fixture shall be supplied with a trap as specified under the separate fixture items. All exposed traps shall be chromium-plated brass with cleanout plugs. Traps shall be provided with washers, heavy nuts for slip joint connections, and standard internal pipe thread at outlets. The traps shall provide a water seal not less than two inches in depth.

d. Flush valves shall conform to Federal Specification WW-P-[illegible]a. Each flush valve shall be provided with a cut-off cock or stop valve immediately adjacent thereto. The body of the stop valve shall be chromium plated brass; moving parts shall be brass and the stop valve handle shall be of the lock-shield type. A metal-to-metal union joint or a threaded adjustable connection with jam nuts and washer shall be provided between the flush valve and the cut-off cock or stop valve. The cut-off cocks or stop valves shall be provided with rubber bumpers to protect the water closet seats. Flush pipe shall be furnished with the flush valve and shall be of chromium plated brass. The supply connections shall be minimum 1-inch I.P.S. Flush pipe connection shall be minimum 1-1/4-inch O.D.

e. Backflow preventers. - Each flush valve shall be supplied with a backflow preventer of the moving part and air vent type which shall be of such size and proportions as to allow an ample flow of water to the fixtures. Backflow preventers shall be of brass, and shall be a complete functioning unit, installed separately or contained wholly within the flush valve body, between the flush valve mechanism and the fixture. When water is not flowing from the flush valve, the moving part or parts shall be actuated by the flowing water and moved into a position that opens the water passage and closes the air vent tightly; and when flow of water stops, the moving part or parts shall return automatically to the normal position of rest. The cycle of motion shall be completed in full with each completed operation of the flush valve, and without the aid of springs or other elastic or flexible part. The operation shall be positive and dependable.

f. Types of fixtures. - The following items specify the types of fixtures which shall be furnished with fixture fittings and trimmings as specified. Each item shall be of the size and type specified, and shall have wall or floor outlet as indicated. References made herein to outfit numbers, paragraphs, patterns, and figures for vitreous china and enameled cast iron plumbing fixtures are "Standard" as manufactured by the American Radiator-Standard Sanitary Manufacturing Co. Equal fixtures of reputable manufacture may be substituted as approved by the Contracting Officer. All fixtures shall be designed to prevent the backflow of polluted water or waste into the water supply system. All fittings installed on fixtures in the building shall have chromium plated finish.

CONNECTICUT RIVER FLOOD CONTROL PROJECT

SPECIFICATIONS

FOR

CONSTRUCTION

OF

BUSHNELL PARK

PUMPING STATION

HARTFORD, CONNECTICUT

14 MAY 1947

WAR DEPARTMENT

CORPS OF ENGINEERS NEW ENGLAND DIVISION

BOSTON, MASSACHUSETTS

Bid No._____ Bidder_____
(Do not write above this line)

Serial No. 19-016-47-90

I N V I T A T I O N F O R B I D S
(CONSTRUCTION CONTRACT)

WAR DEPARTMENT
CORPS OF ENGINEERS
OFFICE OF THE DIVISION ENGINEER
NEW ENGLAND DIVISION
31 ST. JAMES AVENUE
BOSTON 16, MASS.
14 MAY 1947

Project: CONSTRUCTION OF BUSHNELL PARK PUMPING STATION, HARTFORD, CONNECTICUT

1. Sealed bids, in duplicate, will be received until 11:00 A.M., Eastern Daylight Saving Time, 29 May 1947, and then publicly opened, for furnishing all plant, labor, materials and equipment, except materials or equipment specified herein to be furnished by the Government, and performing all work for the above-described project in strict accordance with the specifications, schedules, drawings and addenda.

2. Bids will be submitted in sealed envelopes upon the attached Government form of bid, marked in the upper left hand corner "Bid under Serial No. 19-016-47-90 to be opened 29 May 1947", the serial number indicating the project for which the bid is submitted. The bidder who is awarded the contract will be required to execute the War Department contract form for construction (W.D. Contract Form No. 2). This form is available at the office of the New England Division, Corps of Engineers, War Department, 31 St. James Avenue, Boston 16, Mass.

3. The right is reserved, as the interest of the Government may require, to reject any and all bids, to waive any informality in bids received, and to accept or reject any or all items of any bid, unless the bidder qualifies such bid by specific limitation.

4. Bid bond on U. S. Standard Form No. 24 in a penal sum of not less than twenty (20) per cent of the bid price will be required with each bid.

5. Bidders should carefully examine the drawings and specifications, visit the site of the work, and fully inform themselves as to all conditions and matters which can in any way affect the work or the cost thereof. Should a bidder find discrepancies in, or omissions from the drawings, specifications or other documents, or should he be in doubt as

to their meaning, he should at once notify the Contracting Officer and obtain clarification prior to submitting any bid.

6. Each bidder shall inclose with his bid a statement of whether he is now or ever has been engaged in any work similar to that covered by the specifications herein, the year in which such work was performed and the manner of its execution, and giving such other information as will tend to show the bidder's ability to prosecute the required work.

7. The bidder shall state in his bid that he has available or under his control plant of the character and in the amount required to complete the proposed work within the specified time. Each bidder shall furnish a list of the plant proposed for use on the work.

8. Modifications prior to date set for opening bids. - The right is reserved, as the interest of the Government may require, to revise or amend the specifications and/or drawings prior to the date set for opening bids. Such revisions and amendments, if any, will be announced by an addendum or addenda to this Invitation for Bids. Copies of such addenda as may be issued will be furnished to all prospective bidders. If the revisions and amendments are of a nature which requires material changes in quantities or prices bid or both, the date set for opening bids may be postponed by such number of days as, in the opinion of the Division Engineer, will enable bidders to revise their bids. In such case, the addendum will include an announcement of the new date for opening bids.

FOR THE DIVISION ENGINEER:

K. M. PATTEE
Lt. Col., Corps of Engineers
Executive Officer

STATEMENT OF WORK
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SPECIFICATIONS

PART I

STATEMENT OF WORK

SW-1. DESCRIPTION OF WORK. - a. Work to be done. - The work consists of furnishing all plant, labor, materials and equipment, except materials or equipment specified herein to be furnished by the Government, and performing all work complete in strict accordance with these specifications and schedules and drawings forming parts thereof for CONSTRUCTION OF BUSHNELL PARK PUMPING STATION, HARTFORD, CONNECTICUT.

b. Location. - The site of the work is located in the City of Hartford, Connecticut.

c. Appropriation. - 21X3113 - FLOOD CONTROL, GENERAL.

d. Authority. - The work provided for herein is authorized by the Flood Control Act of 28 June 1938 (Public No. 761, 75th Congress, 3rd Session) as modified by the Flood Control Act of 18 August 1941 (Public No. 228, 77th Congress, 1st Session), and the Flood Control Act of 22 December 1944 (Public No. 534, 78th Congress, 2nd Session).

SW-2. PRINCIPAL FEATURES. - The work to be performed includes the following principal features:

a. Construction of pumping station, storeroom and comfort station combined, in Bushnell Park adjacent to the north side of Park River Conduit and west of Hudson Street.

b. Installation of major pumping station equipment, including pumps, piping and valves, gasoline engines, diesel engine, and right-angle gear units, to be furnished by the Government.

c. Furnishing and installing a traveling crane, gasoline-electric standby unit, mechanically cleaned bar screens, heating and ventilating equipment, sluice gates and hoists, electrical wiring and control equipment, and other auxiliary pumping station equipment.

d. Removing and transporting items of pump equipment from the temporary Bushnell Park Pumping Station, and installing the equipment from the temporary Bushnell Park and temporary Keeney Lane Pumping Stations in the North Meadows Pumping Station, all of

which stations are located in the City of Hartford; also dismounting and remounting existing pump engine in the North Meadows Pumping Station.

The above outline of principal features does not in any way limit the responsibility of the Contractor to perform all work and furnish all plant, labor, materials and equipment required by the specifications and the plans and drawings referred to therein.

GENERAL CONDITIONS
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PART II

GENERAL CONDITIONS

GC-1. SCOPE OF WORK. - The work to be performed under this contract consists of furnishing all plant, materials, equipment, supplies, labor and transportation, including fuel, power, water (except any materials, equipment, utility or service, if any, specified herein to be furnished by the Government), and performing all work as required by Article I of the contract, in strict accordance with the specifications, schedules, and drawings, all of which are made a part hereof, and including such detail drawings as may be furnished by the Contracting Officer from time to time during the prosecution of the work in explanation of said drawings.

GC-2. CHARACTER OF WORK AND MECHANICS. - The work shall be executed in the best and most workmanlike manner by qualified, careful and efficient mechanics in strict accordance with the drawings and specifications.

GC-3. SITE INVESTIGATION AND REPRESENTATIONS. - The Contractor acknowledges that he has satisfied himself as to the nature and location of the work, the general and local conditions, particularly those bearing upon transportation, disposal, handling and storage of materials, availability of labor, water, electric power, roads and uncertainties of weather, river stages, tides or similar physical conditions at the site, the conformation and condition of the ground, the character, quality and quantity of surface and subsurface materials to be encountered, the character of equipment and facilities needed preliminary to and during the prosecution of the work and all other matters which can in any way affect the work or the cost thereof under this contract. Any failure by the Contractor to acquaint himself with all the available information concerning these conditions will not relieve him from responsibility for estimating properly the difficulty or cost of successfully performing the work. The Government assumes no responsibility for any understanding or representations made by any of its officers or agents during or prior to the negotiation and execution of this contract, unless (1) such understanding or representations are expressly stated in the contract and (2) the contract expressly provides that responsibility therefor is assumed by the Government. Representations made but not so expressly stated and for which liability is not expressly assumed by the Government in the contract shall be deemed only for the information of the Contractor and the Government will not be liable or responsible therefor.

GC-4. OPERATIONS AND STORAGE AREAS. - a. All operations of the Contractor (including storage of materials) upon Government premises shall be confined to areas authorized or approved by the Contracting Officer. No unauthorized or unwarranted entry upon or passage through, or storage or disposal of materials shall be made upon Government premises. Government premises adjacent to the construction will be made available for use by the Contractor without cost whenever such

use will not interfere with other Government uses or purposes. The Contractor shall be liable for any and all damage caused by him to such Government premises. The Contractor shall hold and save the Government, its officers and agents, free and harmless from liability of any nature or kind arising from any use, trespass or damage occasioned by his operations on premises of third persons.

b. Temporary buildings (storage sheds, shops, offices, etc.) may be erected by the Contractor only with the approval of the Contracting Office , and shall be built with labor and materials furnished by the Contractor without expense to the Government. Such temporary buildings and/or utilities shall remain the property of the Contractor, and will be removed by him at his expense upon the completion of the work. With the written consent of the Contracting Officer, such buildings and/or utilities may be abandoned and need not be removed.

c. The Contractor shall, under regulations prescribed by the Contracting Officer, use only established roadways or construct and use such temporary roadways as may be authorized by the Contracting Officer. Where materials are transported in the prosecution of the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any federal, state or local law or regulation. When it is necessary to cross curbings or sidewalks, protection against damage shall be provided by the Contractor and any damage roads, curbings, or sidewalks shall be repaired by, or at the expense of the Contractor.

GC-5. BASE LINES AND GRADES. - The Contractor shall lay out his work from base lines and grades established by the Government and shall be responsible for all measurements in connection therewith. The Contractor shall, at his own expense, furnish all stakes, templates, platforms, equipment, ranges, and labor that may be required in setting and cutting, or laying out any part of the work. The Contractor will be held responsible for the proper execution of the work to such lines and grades as may be established or indicated by the Contracting Officer and all stakes or other marks thus established shall be preserved by him until their removal is authorized by the Contracting Officer. The Contracting Officer will furnish, on request from the Contractor, all location and limit marks reasonably necessary for the conduct of the work.

GC-6. PROGRESS CHARTS, AND REQUIREMENTS FOR SUNDAY, HOLIDAY AND NIGHT WORK. - a. The Contractor shall within five days or within such time as determined by the Contracting Officer, after date of commencement of work, prepare and submit to the Contracting Officer for approval a practicable schedule, showing the order in which the Contractor proposes to carry on the work, the date on which he will start the several salient features (including procurement of materials, plant and equipment) and the contemplated dates for completing the same. The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion at any time. The Contractor shall enter on the chart the actual progress at

the end of each week or at such intervals as directed by the Contracting Officer, and shall immediately deliver to the Contracting Officer three copies thereof.

b. The Contractor shall furnish sufficient forces, construction plant and equipment, and shall work such hours, including night shifts, overtime operations and Sunday and holiday work, as may be necessary to insure the prosecution of the work in accordance with the approved progress schedule. If, in the opinion of the Contracting Officer, the Contractor falls behind the progress schedule, the Contractor shall take such steps as may be necessary to improve his progress and the Contracting Officer may require him to increase the number of shifts, and/or overtime operations, days of work and/or the amount of construction plant, all without additional cost to the Government.

c. Failure of the Contractor to comply with the requirements of the Contracting Officer under this provision shall be grounds for determination by the Contracting Officer that the Contractor is not prosecuting the work with such diligence as will insure completion within the time specified. Upon such determination the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part thereof, in accordance with the Delays-Damages Article of the contract.

GC-7. SUBCONTRACTORS. - At the request of the Contracting Officer the Contractor will notify the Contracting Officer in writing of the names of all Subcontractors proposed for the work, as well as those Subcontractors who have been engaged previously, together with the extent and character of the work to be done by each Subcontractor. If, for sufficient reason, at any time during the progress of the work, the Contracting Officer determines that any Subcontractor is incompetent or undesirable, he will notify the Contractor accordingly and immediate steps will be taken for cancellation of such subcontract. Subletting by Subcontractors shall be subject to the same regulations. Nothing contained in this contract shall create any contractual relation between any Subcontractor and the Government.

GC-8. SAMPLES AND DESCRIPTIVE DATA. - a. Any samples and descriptive data required shall:

(1) Be submitted within the time specified in these specifications or, if no time be specified, within a reasonable time before use to permit inspection and testing.

(2) Be shipped prepaid and delivered as specified in these specifications, or as directed by the Contracting Officer.

(3) Be properly marked to show the name of the material, trade name of manufacturer, place of origin, name and location of the work where the material represented by the sample is to be used, and the name of the Contractor submitting the sample.

b. Samples not subjected to destructive tests may be retained until completion of the work but thereafter will be returned to the Contractor, if he so requests in writing, at his own expense. Failure of any sample to pass the specified requirements will be sufficient cause for refusal to consider further any samples from the same manufacturer whose materials failed to pass the tests.

GC-9. PROTECTION OF MATERIAL AND WORK. - The Contractor shall at all times protect and preserve all materials, supplies and equipment of every description (including property which may be Government-furnished or owned) and all work performed. All reasonable requests of the Contracting Officer to inclose or specially protect such property shall be complied with. If, as determined by the Contracting Officer, material, equipment, supplies and work performed are not adequately protected by the Contractor, such property may be protected by the Government and the cost thereof may be charged to the Contractor or deducted from any payments due to him.

GC-10. PRESERVATION OF EXISTING VEGETATION. - a. The Contractor will preserve and protect all existing vegetation such as trees, shrubs, and grass on or adjacent to the site which do not unreasonably interfere with the construction as may be determined by the Contracting Officer. The Contractor will be responsible for all unauthorized cutting or damaging of trees and shrubs, including damage due to careless operation of equipment, stock piling of materials or tracking of grass areas by equipment.

b. Care will be taken by the Contractor in felling trees authorized for removal to avoid any unnecessary damage to vegetation that is to remain in place. Any limbs or branches of trees broken during such operations shall be trimmed with a clean cut and painted with an approved tree pruning compound if required by the Contracting Officer. The Contractor will be liable for or may be required to replace or restore at his own expense all vegetation not protected and preserved as required herein that may be destroyed or damaged.

GC-11. POSSESSION PRIOR TO COMPLETION. - The Government shall have the right to take possession of or use any completed or partially completed part of the work. Such possession or use shall not be deemed an acceptance of any work not completed in accordance with the contract. If such prior possession or use by the Government delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment in the contract price and/or the time of completion will be made and the contract shall be modified in writing accordingly.

GC-12. SUSPENSION OF WORK. - The Contracting Officer may order the Contractor to suspend all or any part of the work for such period of time as may be determined by him to be necessary or desirable for the convenience of the Government. Unless such suspension unreasonably delays the progress of the work and causes additional expense or loss to the Contractor, no increase in contract price will be allowed. In the case of suspension of all or any part of the work for an unreasonable length of time causing additional expense or loss, not due to the fault or negligence of the Contractor, the Contracting Officer shall make an equitable adjustment in the contract price and modify the contract accordingly. An equitable ex-

tension of time for the completion of the work in the event of any such suspension will be allowed the Contractor, provided, however, that the suspension was not due to the fault or negligence of the Contractor.

GC-13. ACCIDENT PREVENTION, FIRE PREVENTION, AND SANITATION. - The handbook, "Safety Requirements", approved by the Chief of Engineers 16 December 1941, as revised 1 January 1946 (copy of which is on file in the office of the authorized representative of the Contracting Officer on the project) and as may be amended, will govern in the prosecution of the work in accordance with the Accident Prevention Article of the contract.

GC-14. LABOR REPORTS. - As required by the Department of Labor, the Contractor shall promptly furnish, and shall cause any Subcontractors to furnish in like manner, within seven days after the regular payment date of each weekly payroll, to the Contracting Officer, a copy of such payroll together with a sworn affidavit with respect to the wages paid each of the employees (which shall not be deemed to apply to persons in classifications higher than laborer and mechanic and those who are the immediate supervisors of such employees) engaged on the work. In addition the Contractor shall furnish, and cause any Subcontractors to furnish in like manner, an additional copy of the payroll together with the sworn affidavit as indicated herein for the weekly payroll period ending nearest January 15, April 15, July 15, and October 15. The Contractor shall also prepare and furnish such other labor reports as may be required by the Department of Labor.

GC-15. PREFERENCE FOR DOMESTIC ARTICLES. - Because the materials listed below, or the materials from which they are manufactured, are not mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, their use in the work herein specified (subject to the requirements of the specifications) is authorized without regard to the country of origin:

Asbestos	Nickel
Chromium	Oil, China wood (Tung oil)
Clay, English ball	Platinum
Clay, English china	Rubber
Copper, natural - nickel alloy	Silk
Cork	Sisal
Jute	Tin
Kaurigum	Wood, Balsa
Lac	Wood, Teak

Articles, materials, or supplies manufactured in the United States and containing mercury, antimony, tungsten, or mica of foreign origin may be used (subject to the requirements of the specifications) in the work herein specified because such manufactured articles, materials, or supplies have been manufactured in the United States substantially all from articles, materials, or supplies mined, produced, or manufactured, as the case may be, in the United States.

GC-16. CLEANING UP. - The Contractor shall at all times keep the construction area, including storage areas used by him, free from accumulations of waste material or rubbish and prior to completion of the work remove any rubbish from and about the premises and all tools, scaffolding, equipment and materials not the property of the Government. Upon completion of the construction, the Contractor shall leave the work and premises in a condition satisfactory to the Contracting Officer.

SPECIAL CONDITIONS
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PART III

SPECIAL CONDITIONS

SC-1 COMMENCEMENT, PROSECUTION AND COMPLETION. - The Contractor will be required to commence work under this contract within fifteen (15) calendar days after the date of receipt by him of notice to proceed, to prosecute said work with faithfulness and energy, and to complete the entire work ready for use not later than five hundred and fifty (550) calendar days after the date of receipt by him of notice to proceed. The time stated for completion shall include final clean-up of the premises.

SC-2. ESTIMATED QUANTITIES. - The quantities listed below are estimates only. Within the limit of available funds the Contractor will be required to complete the work specified herein in accordance with the contract and at the contract price or prices whether it involves quantities greater or less than the following estimates:

Item No.	Estimated Quantities	Unit	Description of Item
1	-	job	Preparation of Site
2	-	job	Control of Water and Sewage
3	6,400	cu.yd.	Common Excavation - General
4	130	cu.yd.	Common Excavation - Trench
5	680	cu.yd.	Rock Excavation
6	-	job	Removing Existing Concrete
7	-	job	Removing 48-inch Reinforced Concrete Pipe
8	-	job	Removing Existing Pumping Station Superstructure
9	350	cu.yd.	Pit-run Gravel
10	700	cu.yd.	Compacted Backfill
11	1,800	cu.yd.	Semi-compacted Backfill
12	120	lin.ft.	Vitrified Clay Pipe, 4-inch
13	80	lin.ft.	Vitrified Clay Pipe, 8-inch
14	145	lin.ft.	Vitrified Clay Pipe, 12-inch
15	100	lin.ft.	Vitrified Clay Pipe, 12-inch, Remove and Reset
16	-	job	Reinforced Concrete Pipe, 24-inch, Remove and Reset
17	100	lin.ft.	Cast Iron Pipe, 4-inch
18	210	lin.ft.	Cast Iron Pipe, 6-inch
19	3	each	Brick Manholes, 5'-0" Deep
20	17	lin.ft.	Brick Manholes - Each Additional Foot of Depth in Excess of 5'-0"
21	-	job	Remodeling Existing Manholes
22	4	each	Concrete Catch Basins
23	1,740	bbl.	Portland Cement
24	890	cu.yd.	Concrete
25	460	cu.yd.	Concrete
26	189,000	lb.	Steel Reinforcement
26A	9,900	sq.ft.	Absorptive Form Lining

Item No.	Estimated Quantities	Unit	Description of Item
27	-	job	Superstructure
28	190	lin.ft.	Brownstone Wall
29	22,000	lb.	Miscellaneous Metal
30	1,850	lb.	Miscellaneous Pipe and Fittings
31	2	each	Mechanically Cleaned Bar Screens
32	3	each	Sluice Gates, Complete with Hoists
33	-	job	Salvage and Reinstallation of Existing 84" by 84" Sluice Gate and Hoist
34	-	job	Heating and Ventilating
35	-	job	Electric Light and Power System
36	-	job	Gasoline-Electric Standby Unit
37	-	job	Traveling Crane, Complete
38	-	job	Water Supply and Plumbing
39	-	job	Carbon Dioxide Fire Extinguishing Equipment
40	-	job	Sump Pump
41	-	job	Gasoline Tank and Piping
42	-	job	Diesel Fuel Tank and Piping
43	-	job	Float Gage
44	-	job	Rubbish Hoist and Sidewalk Doors
45	-	job	Installing Equipment Furnished by the Government
46	3,130	sq.yd.	Grading
47	335	cu.yd.	Topsoil
48	-	job	Insulating 6-inch Water Main
49	675	sq.yd.	Bituminous Macadam Pavement
50	-	job	Removing, Transporting and Installing Pump Equipment
51	-	job	Demounting and Remounting Pump Engine

SC-3. PAYMENTS. - Payments will be made as provided in Article 16 of the contract. Unless otherwise authorized in writing by the Contracting Officer, the items of work for which payment will be made shall be limited to those listed and enumerated in the contract. The unit prices or lump sum price or prices stated in the contract will be used in determining the amount to be paid and shall constitute full and final compensation for all the work.

SC-4. CONTRACT DRAWINGS, MAPS AND SPECIFICATIONS. - a. The work shall conform to the following contract drawings and maps, all of which form a part of these specifications and are available in the Corps of Engineers Office, 31 St. James Avenue, Boston 16, Massachusetts.

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3	Connecticut River - Hydrograph No. 2	CT-3-1236
4	Park River - Hydrograph No. 1	CT-3-1237
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6	General Plan	CT-4-3328
7	Plot Plan	CT-4-3329
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43	Pumping Station, North and West Walls	CT-4-3365
44	East Wall and Screening Chamber Wall Details	CT-4-3366
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b. Ten (10) sets of contract drawings, maps and specifications will be furnished the Contractor without charge. Additional sets will be furnished on request at the cost of reproduction.

c. The Contractor shall submit to the Contracting Officer for approval four (4) copies of all shop drawings as called for under the various headings of these specifications. These drawings shall be complete and shall contain all required detailed information. If approved by the Contracting Officer, each copy of the drawings will be identified as having received such approval by being so stamped and dated. The Contractor shall make any corrections required by the Contracting Officer. Three (3) sets of all shop drawings will be retained by the Contracting Officer and one set will be returned to the Contractor. The approval of the drawings by the Contracting Officer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. Approval of such drawings will not relieve the Contractor of the responsibility for any error which may exist, as the Contractor shall be responsible for the dimensions and design of adequate connections, details and satisfactory construction of all work.

SC-5. PHYSICAL DATA. - The information and data furnished or referred to below are not intended as representations or warranties but are furnished for information only. It is expressly understood that the Government will not be responsible for the accuracy thereof or for any deduction, interpretation, or conclusion drawn therefrom by the Contractor.

a. Subsurface investigation. - (1) Borings. - Borings have been made at the site and in the vicinity of the proposed work and laboratory analyses have been made of the samples of materials taken from some of the borings. The boring samples and results of the studies and analyses pertaining to them may be examined at the Soils Laboratory, New England Division, Corps of Engineers, War Department, Watertown Arsenal, Building 39, Watertown, Massachusetts.

(2) Hydrograph. - Hydrographic data shown on Drawings File No. CT-3-1235, CT-3-1236 and CT-3-1237 were obtained from the United States Weather Bureau.

b. Weather conditions. - The locality is subject to atmospheric temperatures ranging from minus 18 degrees to plus 101 degrees Fahrenheit. The mean annual precipitation at Hartford is 44.90 inches. The mean monthly precipitation varies from a low of 3.08 inches in June to a high of 4.37 inches in July.

c. Transportation facilities. - (1) Railroads. - The New York, New Haven and Hartford Railroad serves the City of Hartford with main line traffic. The Contractor shall investigate the availability of the sidings and make all arrangements for their use for the delivery of any materials and equipment to be used on the work.

(2) Highways. - First-class highways also serve the City. The Contractor shall provide for his own construction or access roads and their maintenance. He shall make his own construction or access roads and their maintenance. He shall make his own investigation of available roads for transportation, of load limits for bridges and roads, and other road conditions affecting the transportation of materials and equipment to the site of the work.

SC-6. DATUM AND BENCH MARK. - The plane of reference of mean sea level datum as used in these specifications is that determined by the following bench mark:

a. Location and Description. - At north entrance to Hartford Post Office, on east side of steps, about 2 feet above sidewalk; standard disc in the upper surface of granite guard block.

b. Elevation. (M.S.L.) 62.417 feet.

c. Identification. Tidal Bench Mark 5.

SC-7. BONDS. - a. Payment Bond. - If the contract price exceeds $2,000.00, the Contractor agrees to furnish a payment bond with good and sufficient surety or sureties acceptable to the Government for

the protection of persons furnishing material or labor in connection with the performance of the work under this agreement on U. S. Standard Form No. 25-A or U. S. Standard Form No. 25-C. The penal sum of such payment bond will be as follows: (1) When the contract price is $1,000,000 or less, 50% of the contract price; (2) When the contract price is in excess of $1,000,000 and less than $5,000,000, 40% of the contract price; (3) When the contract price is $5,000,000 or more, $2,500,000.00.

b. Performance Bond. - If the contract price exceeds $2,000.00, the Contractor further agrees to furnish a performance bond with good and sufficient surety or sureties acceptable to the Government in connection with the performance of the work under this agreement on U. S, Standard Form No. 25 or U. S. Standard Form No. 25-B. The penal sum of such performance bond will be 50 per cent of the contract price (the penal sum of the performance bond will be the same as the penal sum of the payment bond unless otherwise indicated herein).

c. Any bonds required hereunder will be dated as of the same date as the contract and shall be furnished by the Contractor to the Government at the time the contract is executed.

SC-8. PATENT INDEMNITY. - The Contractor agrees to indemnify the Government, its officers, agents, servants and employees, against liability including costs and expenses for infringement upon any Letters Patent of the United States (except Letters Patent issued upon an application which is now or may hereafter be ordered to be kept secret under the provisions of the Act of October 6, 1917, as amended, 35 U.S.C. 4[illegible]) occurring in the performance of this contract or arising (in respect only of inventions which are actually embodied in items manufactured or supplied hereunder, or are involved in the use, unless there be more than one practicable use, of such items) by reason of the use or disposal of such items by or for the account of the Government.

SC-9. RATES OF WAGES. - a. The minimum wages to be paid laborers and mechanics on this project, as determined by the Secretary of Labor to be prevailing for the corresponding classes of laborers and mechanics employed on projects of a character similar to the contract work in the pertinent locality, are as set forth below.

b. Any class of laborers and mechanics not listed below, employed on this contract, shall be classified or reclassified conformably to the schedule set out below by mutual agreement between the Contractor and class of labor concerned, subject to the prior approval of the Contracting Officer. In the event the interested parties cannot agree on the proper classification or reclassification of a particular class of laborers and mechanics to be used, the question, accompanied by the recommendation of the Contracting Officer, shall be referred to the Secretary of Labor for final determination.

Classification of Laborers and Mechanics	Minimum Rates of Wages Per Hour
Air tool operators (jackhammermen, vibrator)	$1.20
Asbestos workers	1.75
Asbestos workers' improvers: 1st year	.85
2nd year	1.05
3rd year	1.15
4th year	1.25
Boilermakers	1.90
Boilermakers' helpers	1.60
Bricklayers	1.90
Carpenters, journeymen	1.75
Cement finishers	1.90
Electricians	1.75
Electricians' apprentices:	
1st 6 months 30% of journeyman rate	
2nd 6 months 35% of journeyman rate	
3rd 6 months 40% of journeyman rate	
4th 6 months 45% of journeyman rate	
5th 6 months 50% of journeyman rate	
6th 6 months 55% of journeyman rate	
7th 6 months 60% of journeyman rate	
8th 6 months 65% of journeyman rate	
9th 6 months 72-1/2% of journeyman rate	
10th 6 months 80% of journeyman rate	
Firemen and oilers	1.125
Ironworkers, structural ornamental, reinforcing	2.00
Ironworkers' apprentices: 1st 6 months	.90
2nd 6 months	1.08
2nd year	1.20
Laborers: Building	1.125
Excavating	1.05
Lathers	1.90
Marble setters	1.90
Marble setters' helpers	1.125
Mason tenders, mortar mixers	1.125
Painters: Brush	1.625
Structural steel, bridge, and water tanks	1.875
Pipelayers (concrete and clay)	1.15
Plasterers	1.90
Plasterers' tenders	1.125
Plumbers	1.75
Plumbers' apprentices:	
1st 6 months 25% of journeyman rate	
2nd 6 months 30% of journeyman rate	
3rd 6 months 35% of journeyman rate	
4th 6 months 40% of journeyman rate	
5th 6 months 45% of journeyman rate	
6th 6 months 50% of journeyman rate	
7th 6 months 57-1/2% of journeyman rate	
8th 6 months 65% of journeyman rate	
9th 6 months 72-1/2% of journeyman rate	
10th 6 months 80% of journeyman rate	

Classification of Laborers and Mechanics	Minimum Rates of Wages Per Hour
Power equipment operators:	
Air-compressors	$1.50
Batching plant operators (asphalt, cement etc.)	1.50
Bulldozers	1.30
Cranes, derricks, draglines, shovels	1.825
Distributors (bituminous surfaces)	1.50
Finishing machines (cem. conc. pave.)	1.50
Graders, blade or motor	1.30
Hoists: 1 drum	1.50
2 or more drums	1.825
On steel	1.925
Mixers: Without loader	1.125
With loader	1.50
Paver operators	1.50
Piledrivers	1.825
Pumps	1.40
Rollers	1.40
Scrapers	1.50
Tractors	1.30
Trenching machines	1.8[illegible]
Riggers--receive rate prescribed for craft performing operation to which rigging is incidental	
Roofers: Composition	1.375
Slate and tile	1.75
Kettlemen	1.25
Sheet metal workers	1.75
Sheet metal workers' apprentices:	
1st 6 months 35% of journeyman rate	
2nd 6 months 40% of journeyman rate	
3rd 6 months 45% of journeyman rate	
4th 6 months 50% of journeyman rate	
5th 6 months 55% of journeyman rate	
6th 6 months 60% of journeyman rate	
7th 6 months 70% of journeyman rate	
8th 6 months 80% of journeyman rate	
Soft floor layers (linoleum)	1.75
Steamfitters	1.75
Stone masons	1.90
Terrazzo workers, tile setters	1.90
Truckdrivers: Dump	1.00
Euclid	1.15
Ready-mixers	1.10
Welders--receive rate prescribed for craft performing operation to which welding is incidental	

SC-10. WATER. - The responsibility shall be upon the Contractor to provide and maintain at his own expense an adequate supply of water of a quantity suitable for his use for construction and domestic consumption. At his own expense he shall install and maintain any necessary water supply connections and piping but only at such locations and in such workmanlike manner as may be authorized by the Contracting Officer. All water shall be carefully conserved. Before final acceptance, temporary connections and piping installed by the Contractor shall be removed in a workmanlike manner to the satisfaction of the Contracting Officer. If it is determined by the Contracting Officer that Government-owned and operated water systems and supplies are adequate for the needs and use of the Contractor as well as the Government, all reasonably required amounts of water will be made available to the Contractor by the Government from such existing water systems and supplies, without cost to the Contractor.

SC-11. ELECTRICITY. - All electric current required by the Contractor shall be furnished at his own expense. All temporary connections for electricity shall be subject to the approval of the Contracting Officer. In the event electricity is made available by the Government, the Contractor shall, at his own expense, install a meter to determine the amount of current used by him, and such electricity shall be paid for by, or will be charged to the Contractor at prevailing rates or at reasonable rates as determined by the Contracting Officer. All temporary lines shall be furnished, installed, connected and maintained by the Contractor in a workmanlike manner satisfactory to the Contracting Officer and shall be removed by the Contractor in like manner at his expense prior to completion of the construction.

SC-12. PLANT. - The Contractor agrees to keep on the job sufficient plant to meet the requirements of the work. Plant shall be kept at all times in condition for efficient work, and subject to the inspection of the Contracting Officer. No reduction in the capacity of the plant employed on the work shall be made except by written permission of the Contracting Officer. The measure of the "capacity of the plant" shall be its actual performance on the work to which these specifications apply.

SC-13. INSPECTION. - The work will be conducted under the general direction of the Contracting Officer and is subject to inspection by his appointed inspectors to insure strict compliance with the terms of the contract. The inspectors will direct the maintenance of the gages, ranges, location marks and limit marks in proper order and position. No inspector is authorized to change any provision of the specifications without written authorization of the Contracting Officer, nor shall the presence or absence of an inspector relieve the Contractor from any requirements of the contract.

SC-14. PROTECTION OF EXISTING STRUCTURES, UTILITIES AND WORK. - The Contractor shall protect all existing structures, utilities and work of any kind against damage or interruption of service. Damage or interruption of service resulting from failure so to do shall be repaired or restored promptly by or at the expense of the Contractor.

SC-15. LIQUIDATED DAMAGES. - a. In case of failure on the part of the Contractor to complete the work within the time fixed in the contract or any extensions thereof, the Contractor shall pay the Government as liquidated damages the sum of fifty dollars ($50.00) for each calendar day of delay until the work is completed or accepted, except as otherwise specified in subparagraph b below.

b. Minor deficiencies in the work and operating deficiencies noted in tests on equipment shall be corrected or adjusted within thirty (30) calendar days after date of completion specified in subparagraph a above. The provisions for liquidated damages shall not apply to the period of time, not exceeding thirty (30) calendar days, allowed by the Contracting Officer to correct or adjust the aforesaid deficiencies, but final payment will not be made until such deficiencies have been satisfactorily corrected or adjusted.

SC-16. GOVERNMENT-FURNISHED MATERIALS OR EQUIPMENT. - The Government will furnish to the Contractor as free issue the following materials and equipment to be incorporated or installed in the work or used in the performance. Such materials and equipment will be furnished f.o.b. railhead nearest the project site, or f.o.b. truck at the project site, and the Contractor will be required to accept delivery when made, pay any demurrage incurred, and unload and transport the materials or equipment to the job site at his own expense. All such materials or equipment shall be installed and/or incorporated into the work at the expense of the Contractor, unless otherwise indicated herein. Any materials or equipment so furnished which are excess, upon the completion of the work, shall remain the property of the Government. The Contractor shall check the quantity and condition of such Government-furnished materials or equipment when delivered to him, acknowledge receipt thereof in writing to the Contracting Officer, and in case of damage to or shortage of such materials or equipment, he shall, within twenty-four (24) hours, report in writing such damage and/or shortage to the Contracting Officer.

Quantity	Item	Description
3	Pump	30" Vertical shaft, volute type
6	Gate valve	30" Hydraulically operated
3	Check valve	30" Horizontal
6	Pipe coupling	30" Flexible
3	Wall casting	30" Suction
3	Wall casting	30" Discharge

Quantity	Item	Description
12	Pipe length	30" flanged one end
3	Gear unit	230 HP right angle
3	Gasoline engine	230 HP complete with flexible exhaust connection, silencer, fuel and water connections and flexible couplings
1	Pump	16" Vertical shaft, volute type
1	Gate valve	16" Hand-operated
1	Gate valve and floorstand	16" Hand-operated
1	Check valve	16" Horizontal
2	Pipe coupling	16" Flexible
1	Wall casting	16" Suction
1	Wall casting	16" Discharge
4	Pipe length	16" Flanged one end
1	Gear unit	70-HP, right-angle
1	Diesel engine	70-HP, complete with flexible exhaust connection, silencer, fuel and water connections and flexible couplings
1	Diesel fuel tank	1000-gallon (see Paragraph TP16-4)
25	Balusters	Brownstone
4	Electric fixture	Commercial office type
6	Electric fixture	Commercial office type for toilet rooms
6	Electric fixture	Commercial pendant type for store room
6	Electric fixture	Ornamental, exterior building type
2	Electric fixture	Ornamental, post type
2	Electric fixture	Commercial wall-mounted pull-chain type
1	Electric fixture	Porch light type
1	Plaque	Bronze
	Fuels and lubricants (see Paragraphs TP13-9c and TP17-7 d)	

SC-17. OBSTRUCTION AND DANGER LIGHTS. - In addition to the requirements of Paragraph GC-13 of these specifications, the Contractor shall comply with all State and local laws and regulations relating to obstruction and danger lights and shall provide, erect and maintain, at no additional expense to the Government, all necessary safeguards, including barricades, warning signs, lights and watchmen. The Contractor shall furnish, erect and maintain, for the duration of the contract, approximately fifty linear feet of wire fencing along the east edge of the existing concrete sidewalk, as indicated on the drawings.

SC-18. REVISIONS TO DRAWINGS. -

a. Sheet No. 26, Drawing No. CT-4-3348. - The note "The size for window type K is 2'-1 5/8" x 3'-1 5/8" stock steel sash, and wire glass" is changed to "The size for window type K is 1'-8 7/8" x 2'-9" fixed steel sash and wire glass."

b. Sheet No. 31, Drawing No. CT-4-3353. - The horizontal dimension of the Boiler Room window openings in the west wall is changed from 2'-1 5/8" to 1'-8 7/8".

c. Sheet No. 46, Drawing No. CT-4-3368. - In Sections C/N 46 and 31, the size of window opening is changed from 2'-1 5/8" x 3'-1 5/8" to 1'-8 7/8" x 2'-9".

d. Sheet No. 71, Drawing No. CT-4-3393. - In the detail titled "Plan", the note "36" dia. Cast iron blank flange to be placed over end of 36" pipe, fastened with 32 1-1/2" bolts" is deleted and the following note is substituted therefor: "36" dia. cast iron blank flange, furnished by the Government, shall be removed from North Meadows Pumping Station and installed over end of 36" pipe."

SC-19. FINAL EXAMINATION AND ACCEPTANCE. - As soon as practicable after the completion of the entire work or any divisible part thereof as may be designated in these specifications, a thorough examination thereof will be made by the Contracting Officer at the site of the work. If such work is found to comply fully with the requirements of the contract, it will be accepted, and final payment thereof will be made in accordance with Article 16 of the contract.

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PART IV

TECHNICAL PROVISIONS

SECTION I. PREPARATION OF SITE (Item 1)

TP1-1. WORK INCLUDED. - The Contractor shall clear, grub and dispose of all materials within the construction limits, including the site of the pumping station and appurtenant structures, areas to be graded, parking areas, and driveways as shown on the drawings or as directed by the Contracting Officer.

TP1-2. CLEARING. - a. Clearing shall include all necessary portions of the following areas: (1) The areas within the working limits of the foundations of the proposed structures and fills, and (2) any other area designated by the Contracting Officer within the limits of the work.

b. Trees and rubbish shall be removed by the Contractor from the sites of the proposed structures and fills, when and as directed by the Contracting Officer, and may be removed from other areas only to the extent directed or permitted. The Contractor shall preserve and protect from injury all trees not required to be removed.

TP1-3. GRUBBING. - The foundation areas of the proposed structures and fills shall be thoroughly grubbed of all stumps, roots, buried logs, and other objectionable matter.

TP1-4. DISPOSAL OF MATERIALS. - All materials removed, as specified above, shall be disposed of by burning or by removal to approved disposal areas as directed. No material shall be thrown into, or left along the bank of the Park River. The disposal of material shall closely follow the operations of clearing. At no time shall material be placed on land adjacent to the construction area.

TP1-5. PAYMENT. - Payment will be made at the contract price for Item 1, "Preparation of Site".

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SECTION II. CONTROL OF WATER AND SEWAGE (Item 2)

TP2-1. WORK INCLUDED. - a. All permanent construction shall be carried on in areas free from water, unless otherwise authorized by the Contracting Officer. Where excavation extends below existing ground water level, the Contractor shall lower the elevation of ground water by approved methods.

b. The Contractor shall maintain existing operating sewers during construction so that their discharges are unimpeded, and shall divert the water away from the permanent construction by methods approved by the Contracting Officer.

c. The Contractor shall submit for approval detailed drawings and data descriptive of the methods he proposes to use for control of water and sewage.

TP2-2. COFFERDAM PROTECTION. - Any suitable type of cofferdam may be used subject to the approval of the Contracting Officer. The Contractor shall be responsible for the adequacy of the cofferdam protection, and for any damage resulting from failure or washing out of cofferdams. Subject to the approval of the Contracting Officer, materials excavated from the work shown on the drawings may be used for constructing cofferdams.

TP2-3. MAINTAINING EXISTING SEWERS. - Provisions shall be made to maintain the satisfactory operation of existing sewers throughout the construction period, unless otherwise authorized by the Contracting Officer. The Contractor shall install temporary sewer extensions and connections, including valves and specials, necessary to divert the water away from the work. The installation of temporary sewer extensions and connections shall include all shoring, excavation, backfilling and other incidental work required to satisfactorily accomplish the work.

TP2-4. PUMPING AND DRAINING. - Before beginning work within the cofferdams, the water shall be diverted and the construction areas shall be unwatered, and shall be kept free from water throughout the working period, unless otherwise authorized by the Contracting Officer.

TP2-5. REMOVAL OF COFFERDAMS AND TEMPORARY SEWER CONNECTIONS. - When the work is finished within the cofferdams or when the need for the cofferdams and temporary sewer connections no longer exists, the temporary protection works, bulkheads and sewer connections shall be removed to spoil areas or otherwise disposed of as approved by the Contracting Officer.

TP2-6. PAYMENT. - The contract price for Item 2 shall include payment for control of water and sewage during construction, and the construction and maintenance of temporary diversion bulkheads and cofferdams, including the rebuilding of diversion works in case of destruction. The contract price for Item 2 shall also include the construction and removal of temporary sewer connections, and maintenance of unobstructed flow through existing sewers encountered in the work. Payment will be made in one sum at the contract price for Item 2, "Control of Water and Sewage", when, in the opinion of the Contracting Officer, the permanent construction no longer requires the protective measures specified under Item 2, and when such protective measures have been removed to the satisfaction of the Contracting Officer.

SECTION III. EXCAVATION (Items 3 to 5 incl.)

TP3-1. GENERAL PROVISIONS. - a. Scope of work. - The location and character of the proposed structures and the location and logs of borings are shown on the drawings. It is the intent of the Government that excavation be made to the lines and grades shown on the drawings, but the right is reserved to modify any part of the work if, in the opinion of the Contracting Officer, conditions require such modification (see Articles 3 and 4 of the contract).

b. Disposal of material. - Material from the excavations suitable for backfill shall be stockpiled and used in the permanent construction as directed by the Contracting Officer. Materials from the required excavations not suitable for use in the permanent construction shall be wasted in spoil areas in approved locations as directed by the Contracting Officer. After completion of the excavation, spoil areas shall be graded and dressed neatly to the satisfaction of the Contracting Officer.

c. Measurement and payment. - A survey of the site area of the specified work will be made just prior to the beginning of the work, and all measurements will be based on this survey, without regard to any changes in the site area that may occur during the prosecution of the work. Measurement for common excavation will be made by the cubic yard between the grade and slope lines indicated on the drawings or staked in the field and the ground surface as indicated by the above-mentioned survey. The Contractor shall remove material which has been deposited subsequent to the above-mentioned survey by floods, rains or other causes, and no payment will be made for such excavation. The slope lines, as shown on the drawings, indicate only the lines to which excavation and fill will be measured and paid for under this contract and are not intended to, and do not represent the actual slope to which the excavation must be made to safely perform the work. The actual slopes may be greater or less than those indicated depending on the materials excavated and methods used in performing the work, but such changes will not change the measurement for payment from the original lines as specified above and as indicated on the drawings or staked in the field. The Contractor will be required to backfill any excess excavation with approved materials, or with additional concrete where excess excavations are adjacent to concrete structures, at no additional expense to the Government.

d. Shoring. - Where approved by the Contracting Officer, shoring may be used in lieu of excavation to the slope or pay lines shown on the drawings. The Contractor shall be responsible for the unfinished work, and that workmen shall be safe from danger of caving or slides while making structure excavations. Shoring shall be erected in a safe and workmanlike manner, and shall be placed in such a way as to afford

ready inspection of and ample clearance for the permanent work. Shoring shall be removed upon completion of the permanent work or as soon as the construction does not require its use. No payment will be made for temporary shoring, but the cost thereof shall be included in the contract price for the excavation. Measurement for payment for the excavation will be made to the pay lines specified in subparagraph c above.

e. Temporary drains. - The Contractor shall maintain the site of the work and adjacent grounds in a well-drained condition. Temporary drains and ditches required shall be constructed by the Contractor at no additional expense to the Government.

TP3-2. CLASSIFICATION. - All materials excavated will be classified as follows:

a. Common excavation shall include all excavation, not otherwise classified, required to complete the work shown on the drawings, that can be removed by hand, power shovels, or draglines without continuous and systematic blasting, and also boulders and detached pieces of solid rock or masonry less than one cubic yard in volume.

b. Rock excavation shall include all solid rock in place required to complete the work shown on the drawings, that cannot be excavated by hand, power shovels, or draglines without continuous and systematic blasting, and also all boulders or rock fragments one cubic yard or greater in volume.

c. Detailed classification is as follows:

(1) Common excavation (see Paragraphs TP3-3 and TP3-4).
General (Item 3)
Trench (Item 4)

(2) Rock excavation (Item 5) (see Paragraph TP3-5).

TP3-3. COMMON EXCAVATION - GENERAL (Item 3). - a. Work included. - The Contractor shall excavate and dispose of the materials classified as common excavation - general to the lines and grades shown on the drawings for the respective areas, or as otherwise directed by the Contracting Officer. Excavation shall be performed in accordance with a schedule of operations to be approved by the Contracting Officer. Common excavation-general includes excavation for the foundation of the pumping station and any other required common excavation for structures, roadways and drains not included in other items of the work (see Paragraph TP2-1 b).

b. Description. - Excavations shall be made wide enough to permit proper sheeting, bracing and form work where necessary. Foundations for the concrete structures shall be excavated as shown on the drawings to suitable undisturbed foundation material approved by the Contracting Officer.

c. Measurement and payment. - Measurement will be made by the cubic yard for the amount of material excavated as specified in Paragraph TP3-1 c. Payment will be made at the contract unit price for Item 3, "Common Excavation - General".

TP3-4. COMMON EXCAVATION - TRENCH (Item 4). - a. Work included. - The Contractor shall excavate and dispose of the materials in the trench for the vitrified clay pipe and for manholes and catch basins, to the lines and grades shown on the drawings, or as otherwise directed by the Contracting Officer. The lines and grades shown on the drawings shall include any necessary adjustment to field conditions.

b. Measurement and payment. - Measurement will be made by the cubic yard for the amount of material excavated as specified in Paragraph TP3-1 c. Payment will be made at the contract unit price for Item 4, "Common Excavation - Trench".

TP3-5. ROCK EXCAVATION (Item 5). - a. Work included. - The Contractor shall excavate and dispose of the rock, wherever encountered, to the lines and grades shown on the drawings or otherwise directed by the Contracting Officer.

b. Blasting. - (1) Explosives shall be used of such quality and power and in such locations as will, in the opinion of the Contracting Officer, neither crack nor damage the rock outside the lines of excavation. Blasting operations shall conform to the provisions of Paragraph GC-13. Blasting shall be done only to the lines and grades shown on the drawings or approved by the Contracting Officer.

(2) The rock surface shall be prepared by drilling, picking, barring, wedging, or similar methods which will leave the rock in a solid and unshattered condition. Where required by the Contracting Officer, the rock shall be cut into rough steps or benches to provide better bond and bearing surfaces. To aid inspection and to insure good bond with the concrete, the rock surface shall be thoroughly cleaned by streams of water or jets of air, or a combination of both, as required by the Contracting Officer (see Paragraph TP6-11 e). No rock shall project within the neat lines of concrete structures built thereon.

(3) Approval by the Contracting Officer of the method of blasting or the strength and amount of the explosive used will not relieve the Contractor of his responsibility in the blasting operations.

c. Measurement and payment. - Measurement will be made by the cubic yard for the amount of rock excavated and satisfactorily disposed of in accordance with the drawings or as directed by the Contracting Officer. Quantities will be measured in place before excavation in accordance with the provisions of Paragraph TP3-1 c. Where a neat line is shown on the drawings, the quantities will be measured or computed to the neat line. Payment will be made at the contract unit price for Item 5, "Rock Excavation".

PART IV

SECTION IV. REMOVAL OF EXISTING STRUCTURES AND APPURTENANCES
(Items 6 to 8 inclusive)

TP4-1. WORK INCLUDED. - a. The Contractor shall remove existing structures and appurtenances, as shown on the drawings, herein specified, and as directed by the Contracting Officer. The work will include removing concrete from the existing temporary Bushnell Park pumping station, concrete sidewalk, removing existing 48-inch reinforced concrete pipe, and removing the wood superstructure and wood trash rack from the existing temporary Bushnell Park pumping station.

b. The removal of existing utilities, required to permit the orderly prosecution of the work covered by the specifications, shall be accomplished by local agencies, unless otherwise shown on the drawings. Whenever a telephone or telegraph pole, pipe line, conduit, fence, sewer, or other utility is encountered, and must be removed to permit completion of the work, the Contracting Officer will notify the proper local authorities and the designated utility will be removed promptly. No additional payment will be made to compensate the Contractor for delays in his work due to failure of any utility to be removed promptly.

TP4-2. REMOVING EXISTING CONCRETE (Item 6). - a. The Contractor shall remove concrete conduit and foundation from the location of the existing temporary pumping station, and concrete sidewalk as shown on the drawings, herein specified, or as directed by the Contracting Officer. Removal of concrete structures shall be done when and as directed by the Contracting Officer (see Paragraph TP4-4 b).

b. The northwesterly concrete wall of the temporary pumping station and conduit shall be removed in its entirety. Other existing concrete work such as floors, foundation walls, steps, etc., shall be removed to a level not less than 2 feet below the finished grade. All exposed reinforcing steel shall be removed or burned off. Broken concrete, thus removed, may be used in the backfill for the abandoned excavation. Existing copper water stop at inlet into Park River Conduit shall be left intact, as far as possible, with additional sheet copper added where required.

c. The Contractor shall remove approximately 12 linear feet of existing concrete sidewalk as shown on the drawings.

TP4-3. REMOVING 48-INCH R. C. PIPE (Item 7). - a. The Contractor shall remove the existing 48-inch reinforced concrete storm sewer pipe and the brick connection at the Park River storm sewer from the locations shown on the drawings.

b. The 48-inch concrete pipe is in 4-foot lengths with mastic joints, approximately 41.5 feet in total length. The Contractor shall disconnect and remove the concrete pipe from the site of the work. The pipe shall become the property of the Contractor.

c. All earth excavation necessary for the removal of the concrete pipe shall be included in the excavation for the pumping station and will be paid for at the contract unit price for Item 3.

TP4-4. REMOVING EXISTING PUMPING STATION SUPERSTRUCTURE (Item 8). - a. The Contractor shall remove the existing Bushnell Park pumping station superstructure and the wood trash rack as herein specified or as directed by the Contracting Officer.

b. The work of removal of the temporary pumping station superstructure and appurtenances shall not be commenced until the new pump equipment is completely installed and ready for operation in the pump room of the building to be constructed under this contract. All materials in the superstructure, including the warm-air furnace, sump pump, and electrical equipment, except the engine batteries, shall become the property of the Contractor and shall be immediately removed from the site of the work. The engine batteries shall be transported to the North Meadows Pumping Station along with the pump equipment (see Paragraph TP20-1).

TP4-5. PAYMENT. - a. Removing existing concrete. - Payment will be made at the contract price for Item 6, "Removing Existing Concrete".

b. Removing 48-inch R. C. pipe. - Payment will be made at the contract price for Item 7, "Removing 48-inch Reinforced Concrete Pipe".

c. Removing existing pumping station superstructure. - Payment for work under this item will be made at the contract price for Item 8, "Removing Existing Pumping Station Superstructure".

PART IV

SECTION V. MISCELLANEOUS BACKFILL AND DRAINS
(Items 9 to 22 incl.)

TP5-1. PIT-RUN GRAVEL (Item 9). - a. Work included. - The Contractor shall place, grade and consolidate materials required for the gravel base for the road and fill around open joint pipe to the lines, grades, and thicknesses shown on the drawings, herein specified, and as directed by the Contracting Officer.

b. Materials. - The materials shall consist of pit-run gravel composed of hard durable particles free from clay lumps and organic material. The gravel shall be composed of such sizes that it will fall within the gradation given below, and it shall be well graded with no predominance of any one size:

Sieve	Amount Passing Total Per Cent by Weight
1/2 thickness of course but not exceeding 4 inches	100
1-inch	50 - 100
4 meshes per inch	25 - 75
10 meshes per inch	13 - 50
48 meshes per inch	3 - 20
200 meshes per inch	0 - 5

The material shall also conform to the following requirement: Per cent of wear, Los Angeles Test, A.A.S.H.O., T-96-38, after 500 revolutions - not more than 50 per cent. If the material, as received, fails to maintain suitable proportions or is not well graded between the maximum and the minimum sizes specified, it shall be rejected or mixed in such a manner as to furnish a material meeting the above requirements. Sources of this material shall be as approved by the Contracting Officer prior to use, and the Contractor shall indicate the sources proposed in sufficient time to allow sampling and testing of the material.

c. Subgrade. - Prior to placing the pit-run gravel base for the access driveway and parking area, the Contractor shall grade the subgrade to the elevations shown on the drawings or as directed by the Contracting Officer, and shall maintain it prior to placing the base. Any ruts or loose subgrade shall be reshaped and compacted by suitable equipment to the satisfaction of the Contracting Officer. Preparation of the subgrade shall be accomplished so far as practicable with approved surplus subgrade material obtained by cutting down the high points to grade. Any additional material required shall be furnished by the Contractor and shall be the finer material contained in pit-run gravel as approved by the Contracting Officer.

d. Placing. - (1) Gravel base for driveway and parking area. - After the subgrade has been properly prepared and compacted and proper drainage provided, the pit-run gravel base shall be spread evenly by means of approved spreader vehicles or trucks to such a depth that, after rolling, it shall conform to the required grade and cross section. The material shall be placed in layers not exceeding 6 inches in thickness. The material as spread shall be well graded with no pockets of fine material or segregation of large and fine particles. After being spread evenly, the material shall be thoroughly compacted by rolling with a self-propelled roller weighing not less than 10 tons, until there is no sinking or creeping ahead of the roller and a firm even surface and required density are obtained. Any portion of the base course which is not accessible to a roller shall be compacted thoroughly with hand tampers weighing not less than 50 pounds, the face of which shall not exceed 100 square inches in area. The Contractor shall provide suitable means for applying water to the gravel base. Water shall be added as directed to facilitate compaction by substantial saturation of the gravel. Rolling shall start longitudinally at the sides and gradually proceed toward the center of the foundation strip, overlapping on successive trips. During the process of rolling, the material shall be dragged; the dragging and rolling shall continue until the material does not creep or wave under the rolling.

(2) Gravel bedding for pipe. - The pit-run gravel shall be placed as shown on the drawings or as directed, and with such hand placing as may be necessary to trim to the required slopes. The Contractor will not be required to tamp or roll the material, but will be required to consolidate it with water to the extent directed so that no settlement or voids will later result.

e. Test requirements for gravel base. - (1) Test samples will be taken at such intervals as will give, in the opinion of the Contracting Officer, a comprehensive knowledge of the material and its placement and compaction in each section of the gravel base.

(2) Compaction of the gravel base course shall attain at least 95 per cent degree of compaction as determined by the Contracting Officer in tests for maximum and minimum density of the soil.

f. Measurement and payment. - Measurement will be made by the cubic yard for the amount of pit-run gravel placed in the completed work, to the lines, grades, and cross sections shown on the drawings or as directed by the Contracting Officer. Quantities will be measured in place after compaction. Payment will be made at the contract unit price for Item 9, "Pit-run Gravel", and shall include all costs of preparing the subgrade, including the disposal of excess materials, and furnishing, placing, rolling, or otherwise compacting the gravel base course, and placing of gravel around open-joint pipe.

TP5-2. COMPACTED BACKFILL (Item 10). - a. Work included. - The Contractor shall place, grade, and consolidate material required for backfill of the parking area and sewer trench as shown on the drawings. The work shall also include the repairs to existing highway upon completion of the sewer pipe connection.

b. Materials. - Materials shall be obtained from stockpiles of excavated materials (see Paragraph TP3-1 b), or may be obtained directly from required excavations. Backfill material shall be free from stumps, roots, sod, rubbish or other unsuitable materials.

c. Placing. - The backfills shall consist of materials suitable for the purpose as determined by the Contracting Officer, and shall be placed in successive layers of not more than 12 inches in depth for the full width of the cross sections. Each layer shall be compacted thoroughly with a crawler-type tractor weighing not less than 20,000 pounds. A minimum of four passes of the tractor treads on each square foot of backfill area will be required for satisfactory compaction. Portions of the backfill area which the compacting equipment cannot reach for any reason shall be thoroughly compacted in 4-inch layers by tamping with hand or power tampers. The compaction for such portions of the backfill shall be equivalent to that obtained with tractor equipment (see Paragraph TP5-3 c (2)).

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of compacted backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the Contracting Officer. Quantities will be measured in place after compaction. Payment for all work in connection with furnishing and placing compacted backfill will be made at the contract unit price for Item 10, "Compacted Backfill".

TP5-3. SEMI-COMPACTED BACKFILL (Item 11). - a. Work included. - The Contractor shall place, grade, and consolidate materials required for backfill of the pumping station structure, miscellaneous structures and elsewhere as directed.

b. Materials. - Materials shall be obtained from stockpiles of excavated materials (see Paragraph TP3-1 b), or may be obtained directly from required excavations. Backfill material shall be free from stumps, roots, sod, rubbish, or other unsuitable materials.

c. Placing. - (1) The backfills shall consist of materials suitable for the purpose as determined by the Contracting Officer, and shall be placed in successive layers of not more than 12 inches in depth for the full width of the cross sections. Each layer shall be consolidated with water or otherwise compacted to the extent directed so that no settlement or voids will later result.

(2) Where backfill is to be placed against only one side of a concrete wall or other structure, or above the concrete conduits, no backfill material shall be placed until the concrete has

been in place at least 14 days. No backfill shall be compacted, nor placed by dragline, clamshell, or other equipment which drops the material in relatively large quantities, nor spread by equipment operating closer to the wall than the height of the wall, until the concrete has been in place at least 14 days, and the supporting floor systems are in place.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of semi-compacted backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the Contracting Officer. Quantities will be measured in place after compaction. Payment for all work in connection with furnishing and placing semi-compacted backfill will be made at the contract unit price for Item 11, "Semi-Compacted Backfill".

TP5-4. VITRIFIED CLAY PIPE (Items 12 to 15). - a. Work included.- The Contractor shall lay, and remove and relay vitrified clay pipe, including specials, of the required diameters for the drainage systems, as shown on the drawings or as directed by the Contracting Officer.

b. Materials. - (1) All pipes shall be bell-and-spigot vitrified clay pipe, conforming to the requirements of Federal Specification SS-P-361a. Each pipe shall be carefully inspected immediately before laying, and no cracked, broken, or otherwise imperfect pipe shall be used, except for minor defects, which, in the opinion of the Contracting Officer, do not impair the fitness of the pipe for the purpose intended.

(2) Subject to the approval of the Contracting Officer, non-reinforced concrete pipe conforming to the provisions of the A.S.T.M. Designation C 14-41, "Concrete Sewer Pipe" may be substituted for vitrified clay pipe. The provisions of subparagraph (1) above, specifying inspection and selection of pipe, shall apply.

c. Excavation. - Pipes, where located in backfill as shown on the drawings, shall be installed by excavating a trench in the previously placed material after the latter has been brought up to a grade approximately one foot above the top of the pipe. Excavation shall be done where required as shown on the drawings and as provided for in Paragraph TP3-4. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe will be firmly supported on the bottom and for at least 3 inches up each side. Where encountered, rock or boulders shall be removed to a depth of 6 inches below the bottom grade of the trench and the voids filled with well compacted suitable material.

d. Laying pipe. - (1) Closed-joint. - All pipe shall be placed in the trenches immediately after excavation is completed. Proper care shall be taken in handling the pipe to avoid injury and breakage. The pipe shall be carefully bedded and properly connected and jointed. Bell holes shall be excavated to insure that each pipe shall rest firmly upon its bed for the entire pipe length. The pipe

shall be laid true to the lines and grades shown on the drawings or staked in the field, with bells upgrade and with spigot ends fully entered into the bells. Joints shall be made with cement mortar composed of one part Portland cement and 2-1/2 parts sand. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable mortar shall be used. Cement and sand used shall meet the requirements of Paragraphs TP6-4 and TP6-5. The spigots shall be centered in the bells, and there shall be no shoulders or unevenness along the invert of the pipes. Special care shall be taken that the joint space be of equal width around the pipe, making use of jute or oakum gaskets soaked in cement grout to center the pipe. The mortar shall be thoroughly troweled into the joint, and a sufficient overfill shall be made to hold the mortar in the joint firmly in place. Mortar joints shall be protected from the sun by a covering of wet burlap or moist earth over the top third of the pipe. The interior of the pipe shall be carefully cleaned after laying to remove dirt, mortar and other obstructions.

(2) Open-joint. - All pipe shall be placed in position after the gravel bedding is completed. Proper care shall be taken in handling the pipe to avoid injury or breakage. The pipe shall be carefully bedded and properly connected and jointed. Each pipe shall rest firmly upon its bed for the entire pipe length. Pipe shall be laid in the gravel and shall be true to the lines and grades shown on the drawing or as established in the field, with bells upgrade and with spigot ends fully entered into the bells. A strip of burlap at least 10 inches wide and of convenient length shall be securely wrapped and tied around the pipe joint.

e. Backfilling. - (1) Pipe with closed joints. - Backfill material shall be evenly spread and compacted under and around the pipe. Backfill over the pipe shall be in accordance with the provisions of Paragraph TP5-3, unless otherwise shown on the drawings or directed by the Contracting Officer.

(2) Pipe with open joints. - Backfill material shall be suitably graded pit-run gravel having a maximum size of 2 inches, and conforming to the requirements of Paragraph TP5-1. The gravel shall be placed around and over the pipe to the limits shown on the drawings or as directed.

f. Measurement and payment. - (1) Measurement will be made by the linear foot for the amount of pipe of the various sizes installed. Payment for pipe will be made at the applicable contract unit prices for Items 12 to 15 inclusive, "Vitrified Clay Pipe", for the various sizes installed, and shall include all costs of furnishing and installing new pipe, and removing, replacing broken lengths, and relaying existing pipe, including specials and other required materials, except the cost of excavation and backfilling.

(2) Payment for excavation will be made at the contract unit price for Item 4 (see Paragraph TP3-4). Payment for earth backfill will be made at the contract unit price for Item 11 (see Paragraph TP5-3 d). Payment for gravel backfill will be made at the contract unit price for Item 9 (see Paragraph TP5-1 f).

TP5-5. REMOVE AND RESET 24-INCH R. C. PIPE (Item 16). - a. Work included. - The Contractor shall remove the 24-inch reinforced concrete pipe from its present location and reinstall it in the new location to the same elevation and slope as the removed pipe. The Contractor shall exercise care in removing and resetting the pipe, and he shall replace with new pipe of equal quality, at no additional cost to the Government, all pipe broken or otherwise damaged as a result of this operation.

b. Excavation and backfill. - The provisions of Paragraphs TP3-4 and TP5-2, respectively, shall apply.

c. Mortar joints. - The provisions of Paragraph TP5-4 d shall apply.

d. Payment. - (1) Payment will be made at the contract price for Item 16, "Reinforced Concrete Pipe - 24-inch, Remove and Reset".

(2) Payment for excavation and backfill will be made at the contract unit prices for Item 4 and Item 10 as applicable.

TP5-6. CAST IRON PIPE (Items 17 and 18). - a. General. - The Contractor shall place cast-iron pipe, including bends, trap, and specials of the required diameters as shown on the drawings or directed by the Contracting Officer.

b. Materials. - All cast iron pipe shall meet the requirements of current American Water Works Association specifications for standard weight pipe, Class A, where applicable, shall be asphalt coated inside and outside and shall have bell-and-spigot joints as shown on the drawings or as directed by the Contracting Officer.

c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph TP3-4. Pipe trenches shall have the dimensions shown on the drawings. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe will be firmly supported on the bottom and for at least 2 inches up each side. Where encountered, rock or boulders shall be removed to a depth of 6 inches below the bottom grade of the trench and the voids backfilled with well compacted suitable material.

d. Laying pipe. - (1) All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be taken in handling the pipe to avoid injury. The pipe shall

be carefully bedded, and properly connected and jointed. The pipes shall be laid true to the lines and grades shown on the drawings or as staked in the field.

(2) Bell-and-spigot joints shall be fully fitted together and shall be made fast by first adjusting the spigot end with wedges to obtain a uniform joint space; and then thoroughly packed with oakum or jute and caulked with lead.

(3) Concrete cradle. - Where shown on the drawings or directed by the Contracting Officer, a concrete cradle shall be constructed beneath the cast iron pipe, substantially of the shape and dimensions shown on the drawings. Concrete shall comply with the applicable provisions of Section VI. The concrete shall be placed in such a manner as to give a satisfactory bed for the lengths of pipe shown. Care shall be taken not to disturb the grade or alignment of the pipe during the placing of the concrete, and the pipe shall be braced and held to resist the buoyancy of the concrete and any other forces exerted during the placing of the cradle.

e. Backfilling. - Backfill material shall be evenly spread and compacted under and around the pipe to the limits shown on the drawings or as directed by the Contracting Officer. Hand tamping shall be done as directed.

f. Measurement and payment. - (1) Measurement will be made by the linear foot for the amount of cast iron pipe of the sizes installed. Payment for pipe will be made at the applicable contract unit prices for Items 17 and 18, "Cast Iron Pipe", except the cost of excavation, backfilling, and any concrete required.

(2) Payment for excavation will be made at the contract unit price for Item 4 (see Paragraph TP3-4 b). Payment for backfill will be made at the contract unit price for Item 11 (see Paragraph TP5-3 d). Payment for concrete will be made at the contract unit price for Item 25(see Paragraph TP6-21 a).

TP5-7. BRICK MANHOLES (Items 19 and 20). - a. General. - The Contractor shall construct brick masonry manholes as shown on the drawings, herein specified, or as directed by the Contracting Officer.

b. Brick masonry. - (1) Brick. - The brick shall be good, sound, hard, and uniformly burned brick, regular and uniform in shape and size, of compact texture and satisfactory to the Contracting Officer. Brick shall comply with Federal Specification SS-B-691, Grade B, standard size 2-1/4 by 3-3/4 by 8 inches. If the Contracting Officer rejects any brick, the same shall be immediately removed and brick satisfactory to the Contracting Officer shall be substituted. Brick shall be culled and compactly piled as soon as delivered.

(2) Mortar. - The mortar shall be composed of one part Portland cement and 2-1/2 parts of sand, to which approximately 20 pounds of hydrated lime shall be added for each sack of cement. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. A minimum amount of water shall be used to make a workable and plastic mortar. Cement, sand, and hydrated lime used in the mortar shall be of approved commercial quality suitable for the use intended.

(3) Brick laying. - The bricks shall be clean and shall be thoroughly wetted before they are put into the work and each brick shall be laid in a full bed and joint of mortar without requiring subsequent grouting, flushing, or filling and shall be thoroughly bonded as directed. Brickwork shall be satisfactorily protected against weather and frost until mortar has set.

(4) Plastering. - Outside faces of brick masonry shall be plastered with a one-inch thickness of Portland cement mortar which shall be carefully spread and thoroughly troweled, leaving a smooth exterior surface.

c. Iron castings. - Manhole frames, covers, gratings and steps shall be in accordance with detail drawings. Frames and covers shall be machined to prevent rocking. The castings shall conform to Federal Specification QQ-I-652. All castings shall be thoroughly cleaned and subjected to a careful hammer inspection for defects before setting. The frame shall be set on top of the brickwork in a bed of mortar. All castings, before being shipped from the foundry, shall be given two coats of coal-tar-pitch varnish, applied to clean surfaces, so as to give a smooth, tough and tenacious coating, without any tendency to scale off.

d. Measurement and payment. - (1) Payment for brick manholes will be made at the contract unit price for Item 19 for manholes 5'-0" in depth as measured from the underside of the concrete base to the top of the rim of the manhole frame; or at the contract unit prices for Item 19 and 20 where the depth of the manholes, constructed as directed by the Contracting Officer and measured as described above, is in excess of 5'-0". Payment shall include all costs to construct the brick manholes, including concrete and castings, to the lines and grades shown on the drawings, except the cost of excavation and backfilling.

(2) Payment for excavation will be made at the contract unit price for Item 4 (see Paragraph TP3-4 b). Payment for backfilling will be made at the contract unit price for Item 11 (see Paragraph TP5-3 d).

TP5-8. REMODELING EXISTING MANHOLES (Item 21). - a. General. - The Contractor shall remodel two existing manholes as shown on the drawings or as directed by the Contracting Officer.

b. Description. - The existing manholes and base shall be remodeled to meet additional requirements. The Contractor shall use care in remodeling the base and brickwork to prevent any damage to the manholes. The base of manhole No. 8 shall be remodeled as shown on the drawings. The top of manhole No. 9 shall be raised to Elev. 27.0, and openings shall be made for one 6-inch cast-iron pipe, one 12-inch vitrified clay pipe, and one 24-inch reinforced concrete pipe. The opening of the existing 24-inch concrete pipe to be removed shall be sealed.

c. Payment. - (1) Payment for remodeling the existing manholes and base will be made at the contract price for Item 21, "Remodeling Existing Manholes", and shall include all work as shown on the drawings or as directed, except the cost of excavation and backfilling.

(2) Payment for excavation will be made at the contract unit price for Item 4 (see Paragraph TP3-4 b). Payment for backfilling will be made at the contract unit price for Item 11 (see Paragraph TP5-3 d).

TP5-9. CONCRETE CATCH BASINS (Item 22). - a. General. - The Contractor shall construct concrete catch basins at the locations indicated on the drawings or as directed by the Contracting Officer.

b. Description. - (1) The catch basins shall conform in shape, size, dimensions and in other respects to the details indicated on the drawings. Excavation shall comply with the provisions of Paragraph TP3-4, as applicable.

(2) The work for the construction of the catch basins shall include concrete, cement, reinforcing steel, cast iron gratings and frames and all other materials required. The concrete shall comply with the applicable provisions of Section VI.

c. Reinforcing steel. - Reinforcing steel shall conform to the provisions of Paragraph TP6-21c.

d. Castings. - Catch basin gratings and frames shall be cast iron, constructed in accordance with the detail drawings. The provisions of Paragraph TP5-7 c shall apply as to type of castings and installation of frames and gratings.

e. Payment. - (1) Payment for constructing the catch basins will be made at the contract unit price for Item 22, "Concrete Catch Basins", except the cost of excavation and backfilling.

(2) Payment for excavation will be made at the contract unit price for Item 4 (see Paragraph TP3-4 b). Payment for backfilling will be made at the contract unit price for Item 10 (see Paragraph TP5-2 d).

PART IV

SECTION VI. CONCRETE (Items 23 to 26A, inclusive)

TP6-1. SCOPE OF THE WORK. - The work covered by this Section consists of the manufacture, transporting, placing, finishing and curing of concrete in the structures included in these Specifications.

TP6-2. COMPOSITION. - Concrete shall be composed of Portland cement, water, and fine and coarse aggregate. The design of concrete mixtures will be based on the water-cement ratio necessary to secure (a) a plastic, workable mixture suitable for the specific conditions of placement and (b), when properly cured, a product having durability, impermeability and strength in accordance with all the requirements of the structures covered by these Specifications. The mixtures will be designed by the Contracting Officer.

TP6-3. WATER CONTENT. - The water content of all concrete mixtures shall be the minimum necessary to properly place the mixture being used.

TP6-4. CEMENT. - a. General. - Bulk cement or cement in cloth or paper bags shall be used for this work, except that cement necessary for grouting, finishing and patching purposes may be packaged.

b. Portland cement. - Portland cement shall conform to Federal Specification SS-C-192, Type I or Type II.

c. High-early-strength Portland cement. - High-early-strength Portland cement shall conform to Federal Specification SS-C-192, Type III, and shall be used only when specifically approved in writing by the Contracting Officer. Concrete made with such cement shall be subject to all applicable provisions of these Specifications.

d. Special test requirements. - Cement will be sampled at the mill and/or at the site of the work. All tests will be made by, or under the supervision of the Government and at its expense. No cement shall be used until notice has been given by the Contracting Officer that the test results are satisfactory. If tests prove that a cement which has been delivered is unsatisfactory, it shall be promptly removed from the site of work.

e. Storage. - Immediately upon receipt at the site of the work, cement shall be stored in a dry, weather-tight and properly ventilated structure with adequate provisions for the prevention of absorption of moisture. All storage facilities shall be subject to the approval of the Contracting Officer. In order that cement may not become unduly aged after delivery, the Contractor shall use any cement which has been stored at the site for 60 days or more before using cement of lesser age. Any cement stored at project site over four (4) months shall not be used unless retest proves it to be satisfactory.

TP6-. FINE AGGREGATE. - a. Composition. - Fine aggregate shall consist of natural sand, manufactured sand, or a combination of natural and manufactured sands. If the fine aggregate is a combination of separately processed sizes, or a combination of natural and manufactured sands, the different components shall be batched separately or, subject to the written approval of the Contracting Officer, blended prior to delivery to the batching plant.

b. Quality. - Fine aggregate shall consist of hard, tough, durable, uncoated particles. The equipment and plant used in the production of the fine aggregate shall be designed for the production of aggregate conforming with the requirements of these Specifications. The stipulated percentages of fines in the sand shall be obtained either by the processing of natural sand or by the production of a suitably graded manufactured sand. If manufactured sand is used, it shall be produced with equipment designed for producing this type of sand. The shape of the particles shall be generally rounded or cubical and reasonably free from flat or elongated pieces. Rock which breaks down into thin, flat, elongated particles, regardless of the type of processing equipment used, will not be approved for use in the production of fine aggregate. A thin, flat, elongated particle is defined as a particle having a maximum dimension in excess of five times the minimum dimension. The fine aggregate shall conform to the following specific requirements:

(1) Grading. - Fine aggregate shall be well graded from fine to coarse, and the gradation shall conform to the following requirements as delivered to the mixers or as incorporated in the mixed concrete:

Sieve Designation U.S. Std. Square Mesh	Cumulative Percentage by Weight Passing	Retained
No. 4	95-100	0-5
No. 8	80-90	10-20
No. 16	55-75	25-45
No. 30	30-60	40-70
No. 50	12-30	70-88
No. 100	3.5-10	90-96.5

In addition to the grading limits shown above, the fine aggregate, as delivered to the mixer, shall have a fineness modulus of not less than 2.40 or more than 2.90 and, during normal operations, the grading of the fine aggregate shall be controlled so that the fineness moduli of at least nine of ten test samples of the fine aggregate as delivered to the mixer shall not vary more than 0.10 from the average fineness modulus. The fineness modulus shall be determined by dividing by 100 the sum of the cumulative percentages retained on U. S. Standard Sieves Nos. 4, 8, 16, 30, 50 and 100. Any washing, screening, classifying, blending, batching or other operations on the sand required to meet this Specification shall be done by the Contractor, and the cost thereof shall be included in the contract unit price for the items of work in which the fine aggregate is used. At the option of the Contractor, fine aggregate

may be separated into two or more sizes or classifications, but the resulting combined sand shall be of uniform grading within the limits specified above.

(2) Soundness. - Suitable tests and the service record will be used to determine the acceptability of the fine aggregate. In the event suitable tests and a service record that are satisfactory to the Contracting Officer are not available, as in the case of newly operated sources, the fine aggregate shall be subjected to such tests as are necessary to determine its acceptability for use in concrete for the proposed structures. The tests to which the aggregate will be subjected will include specific gravity, absorption, soundness in magnesium sulfate, petrographic analyses, freezing and thawing in concrete, alkali-aggregate reaction, and any other tests that are necessary to demonstrate that concrete of acceptable durability over a long period of years can be produced.

(3) Sampling. - All sampling of fine aggregate shall be in accordance with the applicable portions of Federal Specification SS-A-281a, or as directed by the Contracting Officer. The source from which fine aggregate is to be obtained shall be selected well in advance of the time when the material will be required in the work. Samples of the fine aggregate, suitable to the Contracting Officer, shall be furnished at a point designated by the Contracting Officer at least thirty (30) days in advance of the time when the placing of concrete is expected to begin. Unless otherwise specified, all test samples shall be taken under the supervision of the Contracting Officer and delivered to the designated point by the Contractor at his expense. All tests will be made by, and under the supervision of the Government at its expense. Routine control tests and analyses of the fine aggregate at various stages in the processing operations will be made by the Government. The Contractor shall provide such facilities as the Contracting Officer may consider necessary for the ready procurement of representative test samples.

c. Storage. - Fine aggregate shall be stored in such a manner as to avoid the inclusion of any foreign materials in the concrete. The storage piles shall be constructed so as to prevent segregation. The deposition of the material in storage and its removal therefrom shall be done in such a manner as to result in increasing the uniformity of the grading in so far as is practicable. All fine aggregate shall remain in free-draining storage for at least seventy-two (72) hours prior to use. Sufficient live storage shall be maintained at all times to permit continuous placement of concrete at the rate specified in Paragraph TP6-9.

TP6-6. COARSE AGGREGATE. - a. Composition. - Coarse aggregate shall consist of gravel, crushed gravel or stone or a combination thereof.

b. Quality. - Coarse aggregate shall consist of hard, tough, durable and uncoated particles. The equipment and plant used in the production of coarse aggregate shall be designed for the production of aggregate conforming with the requirements of these Specifications. When crushed aggregate is furnished, the dust shall be removed by adequate

washing. The particle shape of the smallest size of crushed coarse aggregate shall be generally rounded or cubical, and the tolerance on flat and elongated particles in all sizes of the coarse aggregate shall be governed by the inherent placeability requirements of the structure in which the mixture is to be placed. A thin, flat and elongated particle is defined as a particle having a maximum dimension greater than five times the minimum dimension. Aggregate which has disintegrated or weathered badly, under exposure conditions similar to those which will be encountered by the structures under consideration, shall not be used. The coarse aggregate shall conform to the following specific requirements:

(1) Grading. - The coarse aggregate shall be well graded from fine to coarse. It shall be separated into the following specific size groups or on other sieves common to local practice which will provide the required number of separations and adequate control of the grading. The grading of the aggregate within the separated size groups shall be as follows:

Sieve Size U.S. Std. Sq. Mesh	Per Cent by Weight Passing Individual Sieves			
	No. 4 to 3/4"	3/4" to 1½"	1½" to 3"	3" to 6"
7"				100
6"				90-100
3"			90-100	0-15
2"			20-55	0-5
1½"		90-100	0-10	
1"		20-45	0-5	
3/4"	90-100	0-10		
3/8"	30-55	0-5		
No. 4	0-5			

The sizes of coarse aggregate to be used in the various parts of the work shall be in accordance with the following or as directed by the Contracting Officer.

LOCATION	DESIGNATED LARGEST SIZE
Item 24	1½
Item 25	1½

(2) Soundness. - Suitable tests and the service record will be used to determine the acceptability of the coarse aggregate. In the event suitable tests and a service record that are satisfactory to the Contracting Officer are not available, as in the case of newly operated sources, the coarse aggregate shall be subjected to such tests as are necessary to determine its acceptability for use in concrete for the proposed structures. The tests to which the aggregate will be subjected will include specific gravity, absorption, Los Angeles Abrasion, soundness in magnesium sulfate, petrographic analyses, freezing and thawing in concrete, alkali-aggregate reaction, and any other tests that are necessary to demonstrate that concrete of acceptable durability over a long period of years can be produced.

(3) Sampling. - All sampling of coarse aggregate shall be in accordance with Federal Specification SS-A-281a, or as directed by the Contracting Officer. The source from which coarse aggregate is to be obtained shall be selected well in advance of the time when the material will be required in the work. Adequate samples of coarse aggregate for all required tests shall be furnished at a point designated by the Contracting Officer at least thirty (30) days in advance of the time when the placing of the concrete is expected to begin. Unless otherwise specified, all test samples shall be taken under the supervision of the Contracting Officer and delivered to the designated point by the Contractor at his expense. All tests will be made by, and under the supervision of the Government at its expense. Routine control tests and analyses of the coarse aggregate at various stages in the processing operation will be made by the Government, and the Contractor shall provide such facilities as the Contracting Officer may consider necessary for the ready procurement of representative test samples.

c. Storage. - Coarse aggregate storage piles shall be built in such a manner as to avoid the inclusion of any foreign material in the concrete and to prevent segregation and excessive breakage. Sufficient live storage shall be maintained at all times to permit continuous placement of concrete at the rate specified in Paragraph TP6-9.

TP6-7. WATER. - Water used in mixing concrete shall be fresh, clean, and free from injurious amounts of sewage, oil, acid, alkali, salts or organic matter.

TP6-8. PROPORTIONING OF CONCRETE. - a. Control. - The proportion of all material entering into the concrete shall be as directed by the Contracting Officer. The Contractor shall provide all necessary equipment and plant to determine and control the actual amounts of material entering each batch. The proportions will be changed whenever, in the opinion of the Contracting Officer, such change is necessary in order to maintain the standard of quality required by these Specifications.

b. Measurements. - All material entering into the concrete shall be mechanically batched and measured by weight. One bag of cement will be considered as ninety-four (94) pounds in weight and one gallon of water as 8.33 pounds.

c. Cement content. - The cement content in the various schedule items of concrete will range from an approximate minimum of 4 to an approximate maximum of 5 bags per cubic yard, depending on the size, type and gradation of aggregate used, and on the structural requirements as determined by the Contracting Officer.

d. Aggregate content. - Concrete mixes will be designed to use the largest size and the maximum amount of coarse aggregate available and placeable in the various parts of the structures, and the aggregate plant will be designed on this basis.

e. Placeability. - The concrete mixtures which have been designed and tested in the laboratory will be adjusted in the field from

time to time to meet the varying conditions encountered during construction. Unless otherwise provided, the concrete shall be so controlled that the slump at all times is kept between one and one-half (1-1/2) inches and three (3) inches when tested in accordance with A.S.T.M. Designation C-143-39.

16-9. BATCHING AND MIXING. - a. Equipment. - The Contractor shall provide at the site of the work a modern and dependable batch-type mixing plant with a minimum capacity of 100 cubic yards of concrete in eight (8) hours. The equipment shall be capable of combining the aggregate, cement and water into a uniform mixture within the time limit specified and of discharging this mixture without segregation. Adequate facilities shall be provided for accurate measurement and control of each of the materials entering the concrete. Any waste resulting from faulty operation of batching equipment, over-batching of materials, or other causes will be charged to the Contractor. The complete plant assembly shall include provisions to facilitate the inspection of all operations at all times. All records and charts of the batching and mixing operation shall be prepared as required herein, and shall become the property of the Government. The plant shall be subject to the approval of the Contracting Officer and shall conform to the following detailed requirements:

(1) The accuracy of the weighing equipment shall conform to the applicable requirements of Federal Specification AAA-S-121b for such equipment. The Contractor shall provide standard test weights and any other auxiliary equipment required for checking the operating performance of each scale or other measuring device. Periodic tests shall be made in the presence of a Government inspector, in such a manner and at such intervals as may be directed by the Contracting Officer. Upon completion of each check test, and before further use of the measuring or recording devices, the Contractor shall make such adjustments, repairs or replacements as may be required to secure satisfactory performance.

(2) Delivery of materials from the batching equipment shall be within the following limits of accuracy:

Material	Per Cent by Weight
Cement	1
Water	1
Aggregate smaller than 1-1/2" size	2
Aggregate larger than 1-1/2" size	3

The batchers shall be arranged to permit the convenient addition or removal of material. Batching equipment shall be so constructed and arranged that the sequence and time of discharge can be controlled to produce a ribboning and mixing of the aggregate and, wherever practicable, of the cement with the aggregate as the materials pass through the charging hopper into the mixer. This control shall be effected by the control of the batcher discharge gates.

(3) Each weighing unit shall include a visible, springless dial or equally suitable device which shall indicate the scale load at all stages of the weighing operation from zero to full capacity.

(4) In so far as practicable, the dial shall be in full view of the operator, and the weighing equipment shall be arranged so that the operator may conveniently observe the operation of the batcher gates and the discharge of the materials.

(5) There shall be provided an automatically printed record of the quantity of cement discharged from the batchers for each batch of concrete. The weight of the cement charged shall be recorded in pounds; the recorder shall be continuous and each batch shall be recorded separately. The interconnecting mechanism from the batcher to the recorder shall be locked and the key therefor turned over to the Contracting Officer.

(6) The batching plant shall be capable of ready adjustment to compensate for the varying moisture content of the aggregate and to change the weights of the materials being batched.

(7) The mechanism for delivering water to the mixers shall be such that leakage will not occur when the valves are closed. The filling and discharge valves for the water tank shall be so interlocked that the discharge valves cannot be opened before the filling valve is fully closed.

(8) The plant shall include a device for indicating and recording the number of batches mixed.

(9) Suitable facilities shall be provided for readily obtaining representative samples of aggregate from each of the batchers for test purposes.

(10) The mixing plant shall be equipped with suitable devices for obtaining representative samples of concrete for slump, unit weight and uniformity tests. All necessary platforms, tools and equipment for obtaining samples shall be furnished by the Contractor. Concrete specimens will be prepared from the mixtures used in the work and tested to determine the adequacy and accuracy of control of the materials entering into the concrete mix. Preparation, storage and testing of the specimens will be at the expense of the Government.

(11) There shall be provided on each mixer an acceptable device to lock the discharge mechanism until the required mixing time has elapsed.

b. Mixing time. - The mixing time for each batch, after all solid materials are in the mixer drum, provided that all the mixing water shall be introduced before one-fourth (1/4) of the mixing time has elapsed, shall be as follows:

Capacity of Mixer	Mixing Time
1/2 cubic yard, or smaller	1-1/4 minutes
3/4 to 1-1/2 cubic yards, incl.	1-1/2 minutes
2 and 3 cubic yards	2 minutes
4 cubic yards	2-1/2 minutes

The mixing periods specified are predicated on proper control of the speed of rotation of the mixer and of the introduction of the materials, including water, into the mixer. The mixing time may be increased when, in the opinion of the Contracting Officer, the charging and mixing operations fail to result in the required uniformity of composition and consistency of the concrete or when test samples of concrete taken from three locations, such as front, center and back of the mixer, show a difference of more than ten (10) per cent in the sand-cement or water-cement ratios. The mixer shall revolve at a uniform speed for a minimum of twelve (12) revolutions after all materials have been placed in it. Mixers shall not be charged in excess of the capacity recommended by the manufacturer, nor shall they be operated at a speed in excess of that recommended by the manufacturer. Excessive overmixing, requiring additions of water to preserve the required consistency, will not be permitted. Should any mixer at any time produce unsatisfactory results, as determined by the Contracting Officer, its use shall be promptly discontinued until it is repaired or replaced.

c. Special equipment. - The use of transit, truck, or agitator-mixed concrete is authorized. The equipment and methods to be used shall be approved by the Contracting Officer in writing. Concrete, so manufactured, shall comply in every respect with these Specifications. The Contracting Officer may, at any time, reduce the size of batches, adjust batching sequences, mixing time or mixing speed, and make such changes as are deemed necessary to obtain concrete of the quality herein specified. Weighing and batching equipment shall conform specifically to requirements of Paragraph TP6-9a, -9a(1), (2), (3), (4), (6), (7) and (8), and except as covered therein, the use of such equipment for mixing and transporting concrete shall be in accordance with applicable portions of A.S.T.M. Designation C 94-44.

TP6-10. CONVEYING. - Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients. There shall be no vertical drop greater than five (5) feet except where suitable equipment is provided to prevent segregation and where specifically authorized by the Contracting Officer. Belt conveyers, chutes or other similar equipment in which the concrete is delivered to the structure in a thin, continuously exposed flow will not be permitted except for very limited or isolated sections of the work and only then if approved in writing by the Contracting Officer. Such equipment shall be arranged to prevent objectionable segregation.

TP6-11. PLACING. - a. General. - Concrete shall be of such consistency and composition that it can be worked readily into the corners and angles of the forms and around all reinforcement and embedded items

without permitting the material to segregate. Concrete shall be deposited as close as possible to its final position in the forms so that flow within the mass and consequent segregation are reduced to a minimum. Placing of concrete shall, as far as practicable, be done by means of bottom-dump buckets of sufficient size to handle the full capacity of one mixer but not to exceed four (4) cubic yards capacity. The design of the buckets shall permit close regulation of the amount of concrete to be deposited in each dumping position. It is contemplated that the full capacity of a bucket may be deposited in one operation, but near forms or embedded items or elsewhere as directed by the Contracting Officer the discharge shall be controlled so that the concrete may be effectively compacted into horizontal layers not exceeding eighteen (18) inches in thickness with a minimum of lateral movement and accompanying tendency for segregation and the formation of rock pockets. Free water shall be collected in depressions away from the forms and removed by bailing prior to placement of additional concrete. All concrete placing equipment and methods shall be subject to the approval of the Contracting Officer.

b. Time interval between mixing and placing. - Concrete shall be placed before initial set has occurred and, unless otherwise authorized by the Contracting Officer, before it has contained its water content for more than forty-five (45) minutes.

c. Placing temperature. - (1) Cold weather. - Concrete shall not be placed when the ambient temperature is below thirty-five (35) degrees F. unless specifically approved, nor when the concrete, without special protection, is likely to be subjected to freezing temperatures before final set has occurred. If concrete is placed when the temperature is below thirty-five (35) degrees F., such placement will be directed by the Contracting Officer in writing, and the materials shall be heated in such a manner that they will be free of ice, snow and frozen lumps before entering the mixer. All methods and equipment for heating shall be subject to the approval of the Contracting Officer. Concrete, when deposited in the forms during cold weather, shall have a temperature of not less than forty (40) degrees F., nor more than sixty (60) degrees F., and shall, at all times, be delivered to the forms at the coolest temperature within the range specified which it is practicable to produce under the current conditions.

(2) Warm weather. - All concrete shall be delivered to the forms at all times at the coolest temperature which it is practicable to produce under current conditions. Concrete placement will not be permitted when, in the opinion of the Contracting Officer, the sun, heat, wind or humidity prevents proper placement and consolidation.

d. Concrete on earth foundations. - Unless otherwise authorized, all concrete shall be placed upon clean, damp surfaces free from frost, ice, standing or running water and never upon soft mud, dried, porous earth, or upon fills that have not been subjected to approved rolling and tamping until optimum compaction has been obtained. The Contractor shall take all measures necessary to accomplish the results contemplated in this paragraph.

e. Concrete on rock foundations. - Rock surfaces upon which concrete is to be placed shall be clean, free from oil, standing or running water, mud, drummy rock, objectionable coatings, debris, loose, semi-detached or unsound rock. Faults or seams shall be cleaned to a depth satisfactory to the Contracting Officer, and to firm rock on the sides. Immediately before concrete is placed, all such rock surfaces shall be cleaned thoroughly by the use of high velocity, air-water jets, wet sandblasting, or other means satisfactory to the Contracting Officer. All installations of riser pipes, headers, sand drains and other installation necessary to produce a foundation free of running or standing water shall be installed by the Contractor and securely fastened in place so as to prevent their being jarred loose by concrete placement. No separate payment will be made for such installations. All rock surfaces shall be kept continuously wet for forty-eight (48) hours, and all approximately horizontal surfaces shall be covered, immediately before the concrete is placed, with a layer of mortar of the same cement-sand ratio as used in the concrete.

f. Vertical joint spacing. - The layout of all monoliths shall be as shown on the drawings or as directed and approved by the Contracting Officer before construction is commenced.

g. Lift in concrete. - The permissible depth of concrete placed in one lift or course will be determined by the Contracting Officer for each structure. All concrete shall be deposited in approximately horizontal layers not to exceed eighteen (18) inches in thickness unless otherwise specifically authorized or directed by the Contracting Officer. The placement shall be carried on at such a rate that all concrete surfaces not yet to grade shall not have reached their initial set before additional concrete is placed thereon. Slabs shall generally be placed in one course unless the depth is so great that this procedure will produce objectionable results. In walls of building, courses including openings shall terminate at the top and bottom of the openings, and other courses shall terminate at such levels as will conform to architectural details.

h. Vibration of concrete. - Concrete shall be placed with the aid of mechanical vibrating equipment and supplemented by hand-spading and tamping. In no case shall vibrators be used to transport concrete inside the forms. The vibrating equipment shall be of the internal type and shall at all times be adequate in number of units and power of each unit to properly consolidate all concrete. Form or surface vibrators shall not be used unless specifically approved by the Contracting Officer. Internal vibrators shall maintain a speed of not less than 6,000 impulses per minute when in operation submerged in the concrete. The intensity (amplitude) of vibration shall be sufficient to produce satisfactory consolidation. The duration of vibration shall be limited to that necessary to produce satisfactory consolidation without causing objectionable segregation. Insertion of the vibrator into lower courses that have commenced initial set or the disturbance of reinforcement embedded in concrete beginning to, or already set shall be avoided. Where absorptive form lining is used, the vibrator shall not be placed between the forms and the outer row of reinforcement, and in no case shall the vibrator be allowed to come in contact with the absorptive form lining.

i. Finishing of concrete lift surfaces. - The manipulation of the concrete adjacent to the surface of the lift in connection with completing lift placement shall be the minimum necessary to produce not only the degree of consolidation desired in the surface layer of concrete, but also a surface with the desired degree of roughness for bond with the next lift. Surface vibration or excessive surface working, including screeding of any kind, will not be permitted. All top surfaces not covered by forms, and which are not to be covered by additional concrete or backfill, shall be carried slightly above grade, as directed by the Contracting Officer, and struck off by board finish.

j. Placing concrete through reinforcement. - In dropping concrete through reinforcement, care shall be taken that no segregation of the coarse aggregate occurs. On the bottom of beams and slabs, where the congestion of steel near the forms makes placing difficult, a layer of mortar of the same cement-sand ratio as used in the concrete shall be first deposited to cover the surface to the extent directed by the Contracting Officer.

TP6-12. CONSTRUCTION JOINTS. - a. General. - After the top surface of a lift is finally compacted, it shall be immediately and carefully protected, for periods as determined by the Contracting Officer, from direct rays of the sun, pedestrian traffic, materials being placed thereon, running water, heavy rain, or any activity upon the surface that in any manner will affect the setting of the concrete. Vertical and horizontal joints on exposed faces shall be chamfered or formed to produce a uniform and neat appearance as indicated on the contract drawings or as directed by the Contracting Officer.

b. Cleaning. - Horizontal construction joints on lifts with relatively open and accessible surfaces may be prepared for receiving the next lift by either wet sandblasting or cutting with an air-water jet, as specified below. However, approved wet sandblasting equipment shall be provided. If the surface of a lift is congested with reinforcing steel, is relatively inaccessible, or if for any other reason the Contracting Officer considers it undesirable to disturb the surface of a lift before final set has taken place, surface cutting by means of air-water jets will not be permitted, and the use of wet sandblasting will be required. All excess water shall be removed from the surface of construction joints before the new concrete is placed thereon. After surfaces have been prepared to the satisfaction of the Contracting Officer, all approximately horizontal surfaces shall be covered by a layer of mortar of the same sand-cement ratio as the concrete. Concrete shall then be placed immediately upon the fresh mortar.

(1) Air-water cutting. - Air-water cutting of a construction joint shall be performed at the proper time after initial set has taken place but before the concrete has obtained its final set. The surface shall be cut with a high pressure air-water jet to remove all laitance and to expose clean, sound aggregate, but not so as to undercut the edges of the larger particles of aggregate. The air pressure used in the jet shall be one hundred (100) pounds, plus or minus five (5) pounds, and the water pressure shall be just sufficient to bring the

water into effective influence of the air pressure. After cutting, the surface shall be washed and rinsed as long as there is any trace of cloudiness of the wash water. The surface shall again be washed with an air-water jet just prior to placing the succeeding lift. Where necessary to remove accumulated laitance, coatings, stains, debris, and other foreign material, wet sandblasting may be required immediately before placing the next lift to supplement air-water cutting.

(2) Wet sandblasting. - When employed in the preparation of construction joints, wet sandblasting shall be performed immediately before placing the following lift. The operation shall be continued until all unsatisfactory concrete and all laitance, coatings, stains, debris, and other foreign materials are removed. The surface of the concrete shall then be washed thoroughly to remove all loose material.

(3) Waste disposal. - The method used in disposing of waste water employed in cutting, washing and rinsing of concrete surfaces shall be such that the waste water does not stain, discolor or affect exposed surfaces of the structures. Methods of disposal will be subject to the approval of the Contracting Officer.

TP6-13. FINISHING. - a. General. - Immediately after removal of forms, all unsightly ridges or lips shall be removed, and undesirable local bulging on the surfaces shall be remedied. Excessive rubbing of formed surfaces will not be permitted. All voids and holes left by the removal of tie rods shall be reamed and neatly filled with dry-patching mortar (pre-shrunk) mixed in the proportions directed by the Contracting Officer. The cement used in the mortar shall be a blend of Portland cement and White Portland cement, properly proportioned so that the final color of the cured mortar will be the same as the color of the surrounding concrete. Defective concrete shall be repaired by cutting out the unsatisfactory material and placing new concrete which shall be formed with keys, dovetails or anchors to attach it securely in place. Concrete for patching shall be drier than the usual mixture and shall be thoroughly tamped into place. All finishing, filling of voids and tie-rod holes, and patching of exposed surfaces shall be performed immediately after the forms are removed, unless otherwise authorized or directed by the Contracting Officer. All unformed surfaces of concrete that are not to be covered by additional concrete or backfill shall have a wood float finish without additional mortar, and shall be true to elevation as shown on the drawings. Care shall be taken to see that all excess water is removed before making any finish. Other surfaces shall be brought to the specified finished elevation and left true and regular. Where indicated on the drawings, joints shall be carefully made with a jointing tool. Every precaution shall be taken by the Contractor to protect finished surfaces from stains or abrasions. Surfaces or edges likely to be injured during the construction period shall be properly protected.

b. Floor and ramp surfaces. - All concrete floors of the building at elevation 16.50 and concrete ramp from the street line to the inside line of sidewalk shall be finished with a 1-inch monolithic

sand-cement mortar surface. All water, laitance and any foreign matter shall be removed from surfaces. The topping mixture shall be spread evenly over all the base within forty-five (45) minutes after the base has been placed. The mortar shall be of 1 part cement and 2 parts approved clean, coarse sand. The cement and sand shall be thoroughly mixed dry, and then sufficient water shall be added to produce a medium stiff mortar. After placing, the mortar shall be floated to a true, regular surface with a wood float and steel-troweled to a smooth finish. Troweling shall be the minimum amount consistent with obtaining a smooth, dense surface, and shall not be done until the mortar has hardened sufficiently to prevent excess fine material from being worked to the surface. The existing concrete sidewalk, broached for the installation of the ramp, shall be repaired to the satisfaction of the Contracting Officer.

TP6-14. CURING AND PROTECTION. - a. General. - All concrete shall be cured for a period of not less than fourteen (14) consecutive days by an approved method or combination of methods applicable to local conditions, except that the curing period may be reduced to seven (7) days for concrete made with high-early-strength cement. The Contractor shall have all equipment needed for adequate curing and protection of the concrete on hand and ready to install before actual concrete placement begins. The curing medium used shall be approved in writing by the Contracting Officer, and shall be applied so as to prevent checking and cracking and loss of moisture from all the surfaces of the concrete, immediately after placing. The curing medium shall be maintained so as to prevent detrimental loss of water from the concrete for the duration of the entire curing period. Unhardened concrete shall be protected from heavy rains, flowing water, or the direct rays of the sun. All concrete shall be adequately protected from mechanical injury. No fire or excessive heat shall be permitted near or in direct contact with concrete at any time. All conduits and other formed openings through the concrete shall be closed during the entire curing period and as long thereafter as practicable to prevent circulation of air and resultant checking and drying of the concrete.

b. Cold weather. - Concrete placed during cold weather shall be kept sufficiently moist at all times during curing period to prevent detrimental loss of water from the concrete. The air in contact with the concrete shall be maintained at temperatures between fifty (50) degrees and seventy (70) degrees F. by suitable covering and heating for at least the first five (5) days, and at a temperature above freezing for the remainder of the specified curing period. The temperature protection equipment and the removal of forms shall be handled in such a manner that the surface concrete will not be subjected to a sudden drop in temperature of more than twenty-five (25) degrees F., as determined by observation of ambient and concrete surface temperatures indicated by suitable thermometers furnished by the Government and installed outside of the concrete and two (2) inches inside the surface of the concrete. The installation of the thermometers shall be made by the Contractor at his expense and at such locations as may be directed by the Contracting Officer. Salt, chemicals or other materials shall not be mixed with the concrete to prevent freezing.

c. Water curing. - Concrete, if cured with water, shall be kept wet by covering with an approved, water-saturated material, or by a system of perforated pipes or mechanical sprinklers, or by any other approved method which will keep all surfaces continuously (not periodically) wet. Where forms of tongue-and-groove lagging are used and left in place for curing, they shall be kept wet at all times to prevent opening at the joints and drying out of the concrete. Water for curing shall be generally clean and free from any elements which, in the opinion of the Contracting Officer, might cause objectionable staining or discoloration of the concrete.

d. Saturated sand curing. - Horizontal construction joints and finished surfaces cured with sand shall be covered with a minimum thickness of one (1) inch of sand which shall be kept uniformly distributed and continuously saturated during the curing period applicable to the surface being cured.

e. Curing compounds. - Curing compounds, where used, shall be of the surface membrane type, of composition and characteristics in accordance with Corps of Engineers Guide Specifications, "Specifications for Curing Concrete by Means of Membrane Compounds." The use of curing compounds on any surface shall be subject to the approval of the Contracting Officer. Curing compounds shall not be used on surfaces to which additional concrete is to be bonded. In cold weather, curing compounds shall not be used on concrete surfaces which are maintained at curing temperature by the use of steam pipes. Curing compounds proposed for use on any vertical surface must be specifically approved in writing by the Contracting Officer.

TP6-15. FORMS. - a. Material. - Forms shall be of wood, steel, or other approved material, except that sheeting for all exposed surfaces, where absorptive form lining is not specified or otherwise authorized, shall be tongue-and-groove lumber of uniform width. Form lining having a glazed, water-tight surface will not be permitted for exposed concrete surfaces or for surfaces where severe weathering or severe hydraulic cavitation or erosion may be experienced. The type, shape, size, quality and strength of all materials of which the forms are made shall be subject to the approval of the Contracting Officer.

b. Construction. - Forms shall be true to line and grade, mortar-tight, and sufficiently rigid to prevent objectionable deformation under load. Where forms for continuous surfaces are placed in successive units, care shall be taken to fit the forms over the completed surface so as to obtain accurate alignment of the surface and to prevent leakage of mortar. Responsibility for their adequacy shall rest with the Contractor. The form surfaces shall be smooth, free from irregularities, dents, sags or holes when used for permanently exposed faces. Bolts and rods used for internal ties shall be so arranged that when the forms are removed, all metal will be not less than two (2) inches from any concrete surface. Wire ties will not be permitted where the concrete surface will be exposed to weathering and where discoloration will be objectionable. All forms shall be so constructed that they can be removed without hammering or prying against the concrete. All exposed

joints shall be chamfered, and suitable moulding shall be placed to bevel or round exposed edges or corners, including the use of dummy chamfers and false joints to provide a neat and uniform appearance, unless otherwise indicated on the drawings or directed by the Contracting Officer.

c. Coating. - Forms for exposed surfaces, except those lined with absorptive form lining, shall be coated with non-staining mineral oil which shall be applied shortly before the concrete is placed. After oiling, surplus oil on the form surfaces and any oil on the reinforcing steel or other surfaces requiring bond with the concrete shall be removed. Forms for unexposed surfaces may be thoroughly wetted in lieu of oiling, immediately before the placing of concrete, except that in freezing weather oil shall be used.

d. Removal. - Forms shall not be removed without the approval of the Contracting Officer, and all removal shall be accomplished in a manner which will prevent injury to the concrete. When forms are removed under conditions of a wide differential of temperature between the concrete and the atmosphere, provision, satisfactory to the Contracting Officer, shall be made for maintaining a blanket of moist air adjacent to the concrete, and thus gradually reducing the temperature differential between the concrete and the surrounding atmosphere. A temperature differential of less than twenty-five (25) degrees F. will be required. (This differential will be determined as in Paragraph TP6-14b). Forms shall not be removed before the expiration of the minimum time indicated below, except as otherwise directed or specifically authorized by the Contracting Officer.

Arches, Beams and Slabs	10 days
Columns	5 days
Walls and Vertical Faces	2 days

When, in the opinion of the Contracting Officer, conditions on the work are such as to justify the requirement, forms may be required to remain in place for longer periods or the above time limits modified where conditions fully justify such modification.

e. Absorptive form lining. - (1) Quality. - The forms for exposed interior and exterior surface of walls, ceilings and beams of the pump room, screening chamber, boiler room, stair hall, hall, storage, and screening chamber stairs shall be lined with an absorptive form lining of approved quality. The form lining shall remain in place after removal of the forms to provide a blanket of moisture on the surface, and to serve as a protection for the concrete surface against staining or abrasion during the curing period. The form lining shall be highly absorptive to air and water, and shall be readily and completely removable from the concrete surface at the end of the curing period. The form lining shall, through its absorptive capacity, eliminate voids, pits, and other common defects of the surface of the concrete placed against it, and shall produce a dense concrete surface of texture satisfactory to the Contracting Officer. The lining shall be easily cut and

fitted, and shall be readily adaptable to any other operation necessary to its use. The lining itself and any treatment employed in its manufacture shall not discolor the concrete or interfere with the normal chemical reaction of the cement in the concrete.

(2) Tests. - The type of lining used shall be subject to the approval of the Contracting Officer. Tests shall be made by the Contractor of all proposed absorptive lining as directed by the Contracting Officer. These tests shall include the use of absorptive form lining on concrete surfaces which will later be covered with backfill. Samples shall also be furnished to the Government for laboratory tests for any type of lining having no previous service record before such lining will be approved.

(3) Installation. - Absorptive form lining shall be attached to the forms in such a manner as to hold the lining snugly in contact with the surface of the forms, free from bulging and other imperfections that might cause unevenness or roughness of the concrete surface. Nails, tacks or staples, if used, shall be driven in a uniform pattern, and shall be flush with the surface of the absorptive form lining. Care shall be taken not to make dents in the surface of the lining with the hammer or in any other manner. After the absorptive form lining has been attached to the form, the joints shall be rubbed with a smooth tool to press down any projecting material. The locations and directions of joints in absorptive form lining shall be as directed or approved by the Contracting Officer. For cutting and trimming the absorptive lining, the Contractor shall use tools which are well adapted to this type of work and are maintained in such condition that smooth edges will be produced. The joints between the sheets of absorptive form lining shall be finished smoothly and accurately, and patching of the sheets will not be permitted. At joints, the edges of the form lining shall be in contact but shall not be pressed tightly together. The Contractor shall avoid splashing mortar or concrete on the absorptive lining, and shall replace sheets of lining which have been damaged. Absorptive form lining shall be used only once and after being used shall be removed from the site. At all times subsequent to the delivery of the form lining and prior to placing the concrete against the lining, the Contractor shall take all precautions necessary to protect the lining from becoming damp or wet to such an extent as to reduce its effectiveness as an absorptive medium. Particular care shall be exercised to protect absorptive form lining during clean-up operations, and temporary protection of such linings will be required. The use of absorptive form lining which has become wet or which contains visible external defects such as holes, ragged or untrue edges, breaks, cracks, tears, protuberances or indentations will not be permitted.

TP6-16. EXPANSION AND CONTRACTION JOINTS. - a. General. - Expansion and contraction joints shall be constructed at such points and of such dimensions as are indicated on the drawings or as required by the Contracting Officer. The method and materials used shall be subject to the approval of the Contracting Officer, and the materials shall conform to Federal Specifications wherever applicable. In no case shall corner protection angles or other fixed metal, embedded in and bonded to the surface of the concrete, be continuous through an expansion.

b. Expansion joint filler. - Where indicated on the drawing, or otherwise required by the Contracting Officer, the expansion joints shall be made by trowelling on the surface the required thickness of bituminous cement containing asbestos fibre or by installing premolded asphaltic joint filler or cork filler of approved quality. Bituminous cement shall be placed at least twenty-four (24) hours prior to the placement of the adjacent concrete unless otherwise approved by the Contracting Officer.

c. Copper water stops. - Copper water stops 8 inches wide, 20 ounces per square foot, shall be installed at the box forms for the intake and discharge wall castings (see Paragraph TP17-5b) as directed by the Contracting Officer. The Contractor shall replace or repair, at his own expense, any water stops punctured or damaged before final acceptance of the work.

TP6-17. STEEL REINFORCEMENT. - a. General. - The Contractor shall cut, bend and place, in accordance with the drawings prepared by the Contractor and approved by the Contracting Officer, all steel reinforcement including rods, dowels, fabric and structural shapes. All reinforcement shall be, when surrounding concrete is placed, reasonably free from rust and scale, and free from oil, grease or other coating which might destroy or reduce its bond with the concrete. The Contractor shall furnish drawings showing bending details and placing schedules of all steel reinforcement for approval by the Contracting Officer.

b. Cutting and bending. - Steel reinforcement may be mill or field bent. All bending shall be in accordance with standard approved practice and by approved machine methods.

c. Quality. - The steel reinforcement shall conform to the requirements of Paragraph TP8-2a(25).

d. Spacing of bars. - The spacing of bars shall be as shown on the contract drawings or as directed by the Contracting Officer.

e. Relation of bars to concrete surfaces. - The minimum cover for all main reinforcement shall conform to the dimensions shown on the drawings. The dimensions, as shown on the drawings, will indicate the clear distance from the edge of the main reinforcement to the concrete surface. The concrete covering of stirrups, spacer bars and similar secondary reinforcement may be reduced by the diameter of such bars.

f. Splicing. - All splices in reinforcement shall be as shown on the drawings or as directed by the Contracting Officer. The lapped ends of bars shall be either separated sufficiently to permit the embedment of the entire surface of each bar in concrete or connected as a single, continuous bar to develop the full strength of the bar.

g. Supports. - All reinforcement shall be secured in place by use of metal or concrete supports, spacers or ties, as approved by

the Contracting Officer. Such supports shall be of sufficient strength to maintain the reinforcement in place throughout the concreting operation. The supports shall be used in such manner that they will not be exposed or contribute in any way to the discoloration or deterioration of the concrete.

h. Protection for future use. - Exposed reinforcement, intended for bonding to future work, shall be protected from corrosion by heavy wrapping of burlap saturated with a bituminous material. Reinforcement so protected shall be thoroughly cleaned prior to subsequent concrete placing.

TP6-18. EMBEDDED ITEMS. - a. General. - Before placing concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings or required by the Contracting Officer. All embedded items shall be thoroughly clean and free of oil and other foreign matter such as loose coatings of rust, paint and scale. The embedding of wood in concrete shall be avoided unless specifically directed or authorized by the Contracting Officer. Metal shall be used instead. Any air or water lines or other materials embedded in structures, as construction expedients authorized by the Contracting Officer, shall conform to the above requirements, and upon completion of their use, shall be backfilled with concrete or grout as directed by the Contracting Officer.

TP6-19. WATERPROOFING. - a. General. - (1) The Contractor shall waterproof (bituminous) the substructure where shown on the drawings. Waterproofing shall be done by experienced mechanics who are regularly engaged in waterproofing of the type herein specified.

(2) Surfaces to receive membrane waterproofing shall be dry and thoroughly cleaned, and shall be firm, free of holes, pockets, cracks, and sharp edges or projections that might break the fabric. No waterproofing shall be applied when the ambient temperature is lower than 45 degrees Fahrenheit. Coal-tar-creosote primer and coal-tar pitch shall be used with coal-tar-saturated cotton fabric. Asphalt primer and asphalt pitch shall be used with asphalt-saturated cotton fabric.

b. Type. - Four-ply waterproofing (hot process) shall consist of four layers of woven cotton fabric and five moppings of hot pitch.

c. Materials. - Materials furnished and installed shall be in accordance with the following specifications.

(1) Waterproof paper shall conform to the requirements of Federal Specification UU-P-536, Grade A.

(2) Coal-tar-saturated woven cotton fabric shall conform to the requirements of Federal Specification HH-C-591.

(3) Asphalt-saturated woven cotton fabric shall conform to Federal Specification HH-C-581a.

(4) Coal-tar-creosote primer shall conform to the requirements of Federal Specification TT-V-560.

(5) Asphalt primer shall conform to the requirements of Federal Specification SS-A-701.

(6) Coal-tar pitch shall conform to the requirements of Federal Specification R-P-381, Type II.

(7) Asphalt pitch shall conform to the requirements of Federal Specification SS-A-666, Type III.

d. Preparation. - Concrete surfaces to receive membrane waterproofing shall be brush-coated with primer, using not less than one gallon per 100 square feet. The primer coat shall be allowed to dry for at least thirty-six (36) hours before applying the waterproofing.

e. Application. - The layers of cotton fabric shall be lapped so that the number of plies specified will be the minimum at every point of the surface to be waterproofed. Each layer of cotton fabric shall be rolled into place, and shall be completely bedded to eliminate air pockets and wrinkles. Each layer of cotton fabric shall be well lapped in the direction of the water flow, with side laps not less than 17 inches, end laps not less than 6 inches, and with all joints broken in adjacent courses. Side laps of cotton fabric laid in single layers shall be not less than 8 inches. At angles, corners, returns and around pipes and openings, the waterproofing shall be lapped 12 inches over the adjacent waterproofing, and in addition shall be reinforced on both sides with two layers of cotton fabric extending at least 12 inches from the intersection. Primer and pitch shall be heated to flow freely, but not above 375 degrees Fahrenheit, and shall be mopped on in uniform coats. The quantities herein specified per square shall be the minimum required to cover 100 square feet of surface. The membrane waterproofing shall be protected as shown on the drawings.

f. Pargeting. - The membrane waterproofing shall be protected on the outside by a 1-inch thickness of pargeting composed of one part Portland cement and two parts sand, applied in two coats, each 1/2 inch thick. The first coat shall be wetted down, if so directed, before the second coat is applied. Care shall be used in applying the pargeting so that the membrane waterproofing will not be displaced or damaged in any manner.

TP6-20. INSTALLATION OF TEST APPARATUS. - The Contracting Officer reserves the right to install pressure cells, stress meters, thermometers and other test apparatus in the foundations and in various parts of the structures for the purpose of making physical measurements and observations. All technical labor, materials, equipment and supplies for this purpose will be furnished by the Contracting Officer. All common labor, materials, equipment and supplies shall be furnished by the Contractor. Installations by the Contracting Officer will be conducted in such a manner as to offer minimum interference with the operations of the Contractor. The Contractor shall conduct his operations in such a manner as to protect the apparatus from injury or displacement.

TP6-21. MEASUREMENT AND PAYMENT. - a. Concrete. - (1) Measurement of concrete will be made on the basis of the actual volume of concrete within the neat lines of the structures as indicated on the drawings or as otherwise required. Measurement of concrete placed against the sides of any excavation without the use of intervening forms will be made only within the neat lines of the structure. No deductions will be made for rounded or beveled edges or space occupied by metal work, electrical conduits or timber, nor for voids or embedded items which are either less than five (5) cubic feet in volume or one (1) square foot in cross-section. Unless otherwise specified, payment for concrete will be made at the respective contract prices per cubic yard for the various items of the schedule, which price shall include the cost of required unloading, handling and storage at the site of all cement used in the work; of all labor; and of the use of all equipment, tools and materials required to complete the concrete work; except the cement, reinforcement, absorptive form lining and embedded parts which are specified to be paid for separately. No payment will be made for concrete, as such, which is placed in structures for which payment is made as a lump sum.

(2) Items for concrete under this contract are as follows:

(a) Item 24. - This item includes all concrete placed in the ramp, sidewalk, discharge conduit, suction conduit, and the pumping station substructure, except the base slab, and other locations shown on the drawings. Payment will be made at the contract unit price per cubic yard for Item 24, "Concrete."

(b) Item 25. - This item includes all concrete placed in the base slab in the pumping station substructure, footing for stone wall, concrete cradles and other locations shown on the drawings. Payment will be made at the contract unit price per cubic yard for Item 25, "Concrete."

(3) Payment for expansion joint material shall be included in the contract unit price for Item 24.

(4) Payment for membrane waterproofing, grouting, pargeting and non-structural brick and concrete below membrane shall be included in the contract unit price for Item 24.

b. Portland cement. - The quantity to be paid for under Item 23, "Portland Cement", will be the number of barrels (376 pounds net weight) of cement actually used in all parts of the work unless specifically excepted, wasted or used for the convenience of the Contractor.

c. Reinforcement. - Measurement of reinforcement will be made of the lengths of bars actually placed in accordance with the drawings or bar schedules approved by the Contracting Officer, or in accordance with the instructions of the Contracting Officer. The measured lengths will be converted to weights for the size of bars listed by the use of the unit weights per lineal foot stated in Federal Specification QQ-B-71a, 1-5. Steel in laps indicated on the drawings

or required by the Contracting Officer will be paid for at the contract unit price. No payment will be made for the additional steel in laps which are authorized for the convenience of the Contractor. Furnishing and placing reinforcement bars will be paid for at the contract unit price per pound for Item 26, "Steel, Reinforcement."

d. Water stops. - Payment for furnishing and installing copper water stops will be included in the contract unit price for Item 24, "Concrete."

e. Absorptive form lining. - The quantity of absorptive form lining paid for will be determined from the number of square feet of concrete surface actually covered. Payment for any material used in connection with the installation or as a part of the lining will be included in the contract unit price for absorptive form lining. Payment for furnishing, installing and removing absorptive form lining will be made at the contract unit price per square foot for Item 26A, "Absorptive Form Lining."

PART IV

SECTION VII. SUPERSTRUCTURE (Items 27 and 28)

TP7-1. WORK INCLUDED. - a. The Contractor shall construct and complete the superstructure of the combined pumping station, storeroom and comfort station, and the enclosing brownstone wall. Item 27 shall include all work incidental to the construction of the superstructure and other miscellaneous work in the building as shown on the drawings and as specified, except such materials and equipment that are specifically included under other items of the contract. Cement, concrete and reinforcing steel will be paid for under the applicable contract unit prices for Items 23, 24, 25 or 26; heating and ventilating under Item 34; water supply and plumbing under Item 38; electrical work under Item 35; and certain items of miscellaneous metal and miscellaneous pipe and fittings, as specified in Section VIII, are included under Items 29 and 30.

b. The work in the building includes structural steel framing, consisting essentially of columns, roof trusses, crane beams, rails, lintels, etc., miscellaneous metal items pertinent to the superstructure, except as specifically included under Item 29; stone, brick and tile masonry; rough and finish carpentry, roofing and sheet metal work; plastering, tile, slate and marble work; weatherstripping, glazing, painting, and all other work that will be required to complete the superstructure in accordance with the specifications and the drawings.

c. The work under Item 28 shall include the construction of the brownstone enclosing wall and gate posts and bronze chains, as shown on the drawings and as specified, except the installation of such materials and equipment that are specifically included under other items of work. Applicable provisions of subparagraph a. above shall apply.

TP7-2. STRUCTURAL STEEL. - a. General. - All structural steel shapes, plates, bars and their products shall conform to the requirements of Federal Specification QQ-S-741, Type I, Grade B. The fabrication and erection of all structural steel shall conform to the requirements of the current "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings", as issued by the American Institute of Steel Construction.

b. Shop drawings. - The Contractor shall submit to the Contracting Officer detailed shop and erection drawings of all structural steel to be installed in the building. Drawings shall be submitted for the approval of the Contracting Officer prior to the fabrication of the steel work.

c. Workmanship. - Shop connections shall be riveted as shown on the drawings. Holes shall not be made or enlarged by burning, nor will the use of a gas-cutting torch in the field for correcting fabrication errors be permitted. Lock nuts shall be used in field bolt connections with threads upset. Bearing plates and anchors shall be properly set during the progress of the work. Columns shall be braced as

soon as they are erected. Extreme care shall be taken, when raising the trusses, not to damage either the trusses or other work in place. Final connections shall not be made until the columns have been plumbed and checked. Drift pins may be used only to bring together the several parts of the work, and shall not be used in such a manner that will distort or injure the steel.

TP7-3. MASONRY. - a. General. - The Contractor shall perform all masonry work as shown on the drawings and as specified. The work shall be properly coordinated with that of all other trades. The work generally will consist of the laying of all cut stone, random ashlar, brick of various descriptions, and structural tile masonry as shown on the drawings. The Contractor shall furnish, for approval of the Contracting Officer, setting drawings of all finished stone and a full-size model of the carved keystone. Each stone shall be numbered and full dimensioned. The Contractor shall also submit for approval samples of stone, granite, brick, structural tile, and glazed brick and tile, showing the quality, textures and finishes of the various types of units to be installed in the work. Before proceeding with the work, the Contractor shall set up a 10-foot long by 10-foot high wall sample of random ashlar at the site of the work for approval by the Contracting Officer. The sample shall show jointing, coursing, finishes and patterns.

b. Materials. - (1) Stone shall be Portland, or equal, brownstone.

(a) Cut stone shall be rubbed finish with trim, coping, quoins, mouldings and ornamental members cut to detail. Balusters will be furnished by the Government (see Paragraph SC-16).

(b) Random ashlar shall be split or sawed face with a portion of the stone finished drove, light crandalled, and broached, as directed by the Contracting Officer. No rock-faced stone will be permitted to be used in the work.

(c) No exterior facing stone shall be less than 4 inches thick.

(2) Flagstone shall be North River, or equal, bluestone flagging, having a split face and a maximum variation of 1/8 inch on the exposed side. Flagging shall have a minimum thickness of 3 inches. Exposed edges of all bluestone shall be 4-cut.

(3) Granite for door sills and outside steps shall be pink "Westerly", or equal, and shall have exposed treads 8-cut, and riser surfaces rubbed finish.

(4) Brick. - (a) Face brick shall be rain-water-struck red brick, range of shades as selected by the Contracting Officer. Old brick of similar type, sound, cleaned and unbroken may be used.

(b) Common brick shall meet the requirements of Federal Specification SS-B-656, Grade H.

(c) Paving brick shall meet the requirements of Federal Specification SS-B-671a, 4" x 3-1/2" x 8-1/2".

(d) Fire brick shall conform to Federal Specification HH-B-671b.

(5) Structural clay tile shall meet the requirements of Federal Specification SS-T-341a for load-bearing tile and SS-T-351a for non-load-bearing tile. Glazed structural units and salt-glazed brick shall conform to the specifications of the Glazed Brick and Tile Institute, Washington, D. C..

(6) Clay tile flue lining shall be "Robinson", or equal, of sizes required.

(7) Masonry cement shall be non-staining conforming to Federal Specification SS-C-181b.

(8) Portland cement shall conform to Federal Specification SS-C-192.

(9) Lime shall be pulverized quicklime or hydrated lime conforming to Federal Specification SS-Q-351. Quicklime shall pass a No. 30 sieve, and at least 90 per cent shall pass a No. 50 sieve.

(10) Sand for mortar mixture shall be well screened, cleaned, hard, sharp, siliceous, free from loam, silt or other impurities, composed of grains of varying sizes within the following limits:

Sieve No.	Per Cent Passing
14	100
20	70 - 90
50	30 - 50
100	5 - 15

(11) Water shall be fresh, clean and free from acid, alkali, sewage or organic matter.

c. Mortar. - (1) Mortar materials shall be accurately measured by volume and thoroughly mixed until evenly distributed throughout the batch. Unless otherwise approved by the Contracting Officer, materials shall be mixed in a mechanical batch mixer. The actual mixing time shall be not less than two minutes. One bag of cement shall be considered as one cubic foot.

(a) Portland cement lime mortar shall be mixed:

1 part Portland cement.
1-1/2 parts lime putty.
7 parts sand.

(b) Non-staining cement mortar shall be mixed:

1/2 part hydrated lime.
1 part non-staining cement.
2-1/2 parts sand.

(2) Lime putty. - Lime putty may be hydrated lime or prepared quicklime. Hydrated lime shall be mixed with water to form a putty and stored with reasonable care to prevent evaporation for at least 24 hours before use. Quicklime shall be slaked with enough water to make a cream, passed through a No. 10 sieve, and then stored with reasonable care to prevent evaporation for at least 7 days before use.

d. Anchors and ties shall be provided as required to secure and bond all masonry as shown on the drawings or as directed by the Contracting Officer.

(1) Wall ties shall be not less than No. 12 gage galvanized for exterior face brick, and for interior brick and terra cotta facing, shall be "Ankortite" made by Ankortite Products, Inc., Kansas City, Mo., or equal.

(2) Anchors and dowels for cut stone shall be not less than 1/2-inch diameter brass dowels.

e. Laying conditions. - Masonry shall not be laid when temperature is below 40 degrees Fahrenheit, except with the permission of the Contracting Officer. When permission is given, the Contractor shall provide a satisfactory method of heating the materials before laying, and protecting the finished work against freezing. Brick having a greater than 12 per cent absorption shall be wetted 24 hours before laying, to reduce the suction of water from the mortar, except when, in the judgment of the Contracting Officer, the temperature is too low. Freshly wetted brick or brick having a film of water or frost on their surfaces shall not be laid into the walls.

f. Workmanship. - (1) Stone. - (a) The setting of stone masonry shall be performed by competent, experienced workman and in strict accordance with the drawings, approved sample, and specifications. All stone work shall be laid on its natural bed and in non-staining, cement-lime mortar. All mortar shall be colored with mineral pigment mortar, color as directed by the Contracting Officer. Each stone shall be carefully lowered so as not to injure the stonework or displace the adjacent members. Stones shall be accurately set, with finish joints not to exceed 3/4 inch for random ashlar and 1/4 inch for cut stone, and located as shown on the drawings for corners, jambs and other special locations. All joints shall be completely filled with mortar and shall be finished and pointed as the stones are laid and before the mortar has attained its final set. Body jointing shall

not exceed 3 inches in depth of mortar. A sufficient number of suitable temporary wooden wedges shall be used in setting the stones to maintain alignment and a uniform width of finish joint and to prevent settlement. Wooden wedges shall be thoroughly soaked in water before using and shall be removed entirely as soon as the mortar has set sufficiently to bear the weight of the stone. Permanent leveling of stones shall be accomplished by the use of lead plugs or buttons set at least one inch back from finished face of stone and carefully embedded and surrounded by mortar. The height of stones shall be between 6 inches and 16 inches. The average length of stones shall not exceed three times the height. A small percentage of spalls shall show on the face. Cutting and drilling for pipe, electrical conduits, outlets, etc., shall be performed carefully by skilled craftsmen. Stones shall be trimmed and fitted to overcome inaccuracies. Reglets for flashings shall be cut as required. Weep holes, entirely through the stone facing, formed by 3/8-inch, non-ferrous rods set on 3-foot centers, shall be set along the top of the base course to ventilate the air spaces and voids and relieve dampness. The rods shall be removed before the mortar has attained its final set. Window and door sills shall be bedded at the ends only until the adjacent mortar is set. Faces of stone shall be kept free of mortar at all times. Masonry work shall be kept wet by sprinkling with water until the mortar has become entirely set and hard enough to prevent its drying and cracking. All flashings shall be installed concurrently with the masonry where indicated on the drawings. All finish joints shall be flush.

(b) Brownstone facing for engine and store rooms shall average 6 inches in thickness. At least 20 per cent of the brownstone facing shall be not less than 10 inches in thickness to bond the facing stones securely to the common brick back-up. The bonding stones shall be evenly distributed throughout each wall area to provide uniform anchorage.

(c) Brownstone facing for comfort station shall average 4 inches in thickness. At least 20 per cent of the brownstone facing shall be not less than 8 inches in thickness to bond facing stones securely to the common brick back-up. The bonding stones shall be evenly distributed throughout each wall area to provide uniform anchorage.

(d) Where indicated on the drawings for full thickness of stone walls, bond stones in ashlar shall be carried through for the full thickness of walls, and shall constitute not less than 25 per cent of the superficial surface.

(2) Brickwork. - (a) Common brick shall be laid up in cement-lime mortar with approximately 3/8-inch joints, well bedded and tied in with full headers at every sixth course. Generally whole

brick shall be used throughout, with bats only on the inside body of the work to fill out the courses. Pointing shall be close to all sills, copings and projections. On interior walls, not to be plastered, all brick shall be laid up with neatly struck (flush) joints and left clean for painting. All frames shall be solidly bedded, and all built-in materials pertaining to other branches of construction shall be installed as the work progresses including frames, anchors, lintels, nailing blocks, strips, plugs, etc. Chases, pockets, holes, etc., required in walls for piping, mechanical, or electrical work shall be provided for work of these other trades. Locations for such openings shall be established well in advance of the work being laid up, as the cutting of all chases in walls shall be accomplished by the Contractor, in all cases, at no additional expense to the Government. Openings for which steel lintels are not provided shall be arched, as required, with 2 or 3 rowlock arches having a one-inch rise to each foot of span, except as otherwise indicated on the drawings. The first 4 inches of brick in back of all stone shall be laid up in non-staining cement mortar.

(b) Face brick shall be laid up in non-staining cement-lime mortar, colored as directed, 4 courses to 10-1/2 inches with approximate 3/8-inch finish joints, well bedded, thoroughly slushed and bonded to backing and laid as shown. All face brick shall be laid up from scaffolding. Brick over arched openings shall be ground or molded to shape with all sides of radial joints parallel. Face brick will not be required on surfaces concealed by steps, cornices, sheet metal, stone, or exterior trim. Interior joints shall be struck flush; exterior joints shall be weather-struck.

(3) Terra cotta tile and furring shall be laid up in cement-lime mortar in horizontal courses, with vertical joints broken, and solidly bedded in mortar, as specified in subparagraph c (1) (a) above. Vertical joints shall be well filled and tile shall be shoved to a bearing with as close a joint that is consistent with good workmanship, with all crevices pointed and filled. Faces of walls shall be carried up plumb and true. Partitions shall start on curbs and extend to the underside of beams or beyond finish lines above, as directed. Where double partitions are shown enclosing piping, the enclosing partitions shall not be constructed until all piping is in place, tested, inspected and approved. Wall plugs, blockings, strips, etc. shall be built in as required. Lintels over openings shall be formed by previously setting up the tile and placing 5/8-inch diameter reinforcing bars through the cores of the tile and filling with concrete to form a continuous lintel with not less than 6-inch bearing at each end. Openings larger than 4'-0" shall have lintels reinforced as directed or shown on the drawings.

(4) Glazed structural units shall be laid up with cement-lime mortar finish joints, 1/4 inch thick, set with a flush finish joint. Tile shall be tied with metal ties as specified in subparagraph d above. All cutting and fitting around all mechanical equipment, pipes, outlet boxes, etc., shall be accurately executed. Upon completion, the work shall be thoroughly cleaned.

(5) Paving brick shall be set on a thoroughly compacted bed of sand 2 inches thick and grouted with cement mortar, with finish joints 1/4 inch wide. The surfaces of the paving brick shall be given a brush coating of linseed oil or clear paraffin oil and the grout shall be poured over the surface and swept into the joints and smoothed flush with the brick. After setting but before the grout has reached initial set, the brick shall be rolled with a garden roller. The floor shall be thoroughly washed and cleaned after completion.

(6) Flagstone shall be set in a cement-lime mortar bed, 3/4 inch thick with finish joints 1/4 inch wide, left one inch deep for finish pointing. Finish pointing shall be done with lead wool, well calked and left flush.

(7) Fire brick shall be laid in the fireplace, smoke chamber, boiler hearth, and two chimney flues as shown on the drawings. The firebrick shall be laid in fire clay. Fire brick shall be laid either flatwise or edgewise as shown on the drawings.

(8) Masonry flues of boiler room and fireplace shall be clay-tile flue lining. Cast-iron cleanout door shall be installed approximately 36 inches above the floor of the boiler room and centered on the flue below the smoke inlet. Clay-tile thimble for smoke pipe, of required size, shall be installed where indicated on the drawings or directed by the Contracting Officer.

g. Cutting and patching. - All other trades shall be consulted in advance of operations and provisions shall be made for the installation of their work to avoid cutting and patching. Any cutting or patching of masonry required to accommodate the work of others shall be done by the Contractor at no additional cost to the Government.

h. Protection. - The Contractor shall properly protect surfaces of masonry when they are not being worked upon. Protection from frost shall be provided when and where necessary. At the end of each day or when rain or snow is imminent, the tops of masonry walls and similar surfaces shall be covered with a strong waterproof membrane well secured in place to keep water from entering the top of the wall.

i. Pointing and cleaning. - On completion of work, the Contractor shall point up all exposed masonry, filling all holes and joints, and shall clean down the work, using acid solution no stronger than vinegar and stiff fiber brushes, leaving the masonry clean, free of mortar on the face, and in good condition with tight mortar joints throughout. After cleaning, all masonry shall be well rinsed with clean water. Care shall be taken to remove all forms of wood from all parts of the work. Floors shall be left in a clean condition and any work damaged from any cause shall be repaired, so that the completed work is left in a condition satisfactory to the Contracting Officer.

TP7-4. CARPENTRY. - a. General. - (1) The Contractor shall perform all work in connection with rough and finish carpentry, millwork, rough and finish hardware as shown on the drawings, herein specified and as directed by the Contracting Officer.

(2) The Contractor shall do all cutting and render other carpenter assistance required for other branches of the work, making good after other mechanics, and shall furnish all necessary grounds, wood strips, blocks, nailers, plugs, etc. The workmanship shall be first-class in every respect.

b. Materials. - (1) Lumber shall conform to the following specifications:

Soft wood - Federal Specification MM-L-751c.

Hard wood - Federal Specification MM-L-736.

Lumber, not otherwise specified, shall be dried to a moisture content not exceeding 19 per cent. All lumber for finish and millwork shall be kiln-dried and free from loose knots, checks and other defects.

(a) Sizes marked on drawings and mentioned in specifications are sizes of rough stock. The stock, except as otherwise specified, shall be dressed to conform to Yard Size Standard in American Lumber Standards, unless Standard Industrial Sizes are specifically required.

(b) All lumber shall be "grade marked" by the Association under whose rules it is graded or each shipment shall be accompanied by a "Certificate of Inspection" issued by the said Association.

(c) All lumber for half-timber and exterior oak trim shall be pressure-treated with Chromated Zinc Chloride Wolman Salts as manufactured by the Wood Preservative Division of the Koppers Company, or equal. All doors and frames, wood sash and frames and other fabricated mill work shall be toxic-preservative-treated in accordance with the minimum standards of the National Door Manufacturers Association, Inc., or equal.

(d) All material when delivered to the site shall be piled to insure proper drainage, ventilation, and protection from the weather.

(e) Lumber for various uses shall be of the species listed and the grades specified, or as otherwise approved by the Contracting Officer.

Use	Quality	Species
Trusses, purlins, and rafters	No. 1 factory clear	(Long leaf yellow pine (Douglas Fir
Sheathing, grounds, roof planking	A	(Southern Pine (Eastern Spruce (White Fir (W.C. L.A. rules) (White Pine
Sash, frames, exterior and interior trim, finish, etc.	"B" and Btr."	(White Pine
Exterior doors, frames, trim and half-timber	FAS	(White Oak
Stair rails	FAS	(Birch

(2) Screen cloth shall conform to the requirements of Federal Specification RR-C-451a, Type C, 16- and 20-mesh, as required, and 1/4-inch mesh, .047-inch copper wire, for panels of screen doors and for window screens.

(3) Nails shall conform to the requirements of Federal Specification FF-N-101.

(4) Screws shall conform to the requirements of Federal Specification FF-S-111.

(5) Bolts, washers and anchors. - All bolts, washers, and anchors shall be of standard type.

(6) Steel plates and shapes. - Items involving steel plates and shapes shall be made of steel conforming to the requirements of Federal Specification QQ-S-741 and as detailed on the drawings.

c. Workmanship. - (1) Rough carpentry. - Framing shall be erected true to lines, levels, and dimensions, squared, aligned, plumbed, well spiked or bolted and adequately braced. Plates shall be set level, slushed in mortar, and anchored. Structural members shall be set with the crown edge up. Trusses and purlins shall be cut accurately to detail. Roof planking shall be laid up as shown on the drawings, well driven up, and blind- and face-nailed to each bearing, using two 16d nails im plank up to 8 inches in width and three 16d nails for widths over 8 inches. All face nails shall be set. All rough wood bucks shall be 2 inches thick, or as detailed, and shall be anchored with 2" x 1/8" x 16" galvanized iron strap anchors turned up 2 inches on the ends. Not less than three anchors shall be installed on each jamb. Grounds shall be brought to the exact plane of finish around all openings in walls to be plastered, including openings for exhaust registers and grille openings. Generally, grounds shall be 3/4 inch thick, but may be varied to meet special requirements.

(2) Finish carpentry. - Workmanship in connection with window frames and sash, door frames and doors, exterior and interior trim, screens and screen doors, and other items not specifically described, shall conform to finish carpentry standards and shall be acceptable to and approved by the Contracting Officer. Material shall be clear lumber, moulded and executed as detailed, and noted on the drawings, hand-smoothed with fine sandpaper. Trim shall be mitered, splined, and glued at the mill. All exterior trim shall be assembled in the most approved weather-tight method, with members joined with miter joints, and rake and cornice members mitering perfectly.

(3) Half-timber work shall be full thickness white oak stock and shall be trimmed and installed as shown, and shall have exposed surfaced hand-hewn, broad adz work, scored, and rived. Concealed faces and back of half-timber shall be covered and weatherproofed with heavy bituminous felt. Half-timber shall be anchored to the masonry, with metal ties and flashed with 16-ounce lead-coated copper as detailed.

(4) Doors and frames. - (a) All exterior doors, frames and trim shall be constructed of white oak as detailed, including panels, facings, staff beads, etc. Door frames shall be rabbeted and shall be anchored as specified or as detailed for wood door bucks. The bottom edges of all doors shall be provided with drip mouldings as shown on the drawings. All wood frames set into or against masonry walls shall be heavily primed on concealed faces prior to installation.

(b) Wrought iron, bound on exterior faces of engine-room entrance doors, shall be applied and bolted with round heads screwed on as shown on the drawings.

(5) Window frames and sash. - (a) All window frames shall be as detailed, white pine, rabbeted for casement or steel sash, as required. Frames shall be erected before masonry jambs are built, perfectly plumb and true and shall be substantially braced. Staff beads shall be of white oak and shall be removed before erection and reset after frames are calked. All wood frames set into or against masonry walls shall be heavily primed on concealed faces prior to installation.

(b) All wood sash shall be 1-3/4-inch white pine, assembled with mortise and tenon joints using through tenons in all cases, securely wedged, planed, glued and pinned. The stiles and rails shall be moulded and rabbeted to receive the glazing. Each sash shall be fitted to the frame.

d. Calking. - After all exterior door frames, sash frames and louvers have been built into place, all openings shall be carefully and thoroughly calked on all sides, sills and heads, with an approved calking compound of gun consistency, colored as directed, driven into place from the outside and tightly filling the spaces between the frames and the masonry before the staff beads are installed. Calking compound shall be similar and equal to that manufactured by H. B. Fred Kuhls, Sonneborn Sons, Inc., or Pecora Paint Co., Inc.

e. Screens. - All wood sash, except sash in the store room, shall be provided with hinged, full-height, interior-hung screens. Stiles and top, intermediate and bottom rails shall be of 1-1/8-inch thick white pine. Screen doors shall be installed at all exterior door openings except at the engine room, screening chamber stairway, and store room. Stiles and rails of screen doors shall be constructed of 1-1/4-inch thick white pine. Window screens shall have 20-mesh bronze wire and screen doors shall have 16-mesh bronze wire laminated with 1/4-inch copper screening.

f. Interior and exterior woodwork not to be stained shall be primed and backpainted, unless otherwise specified or directed.

g. Weatherstripping. - (1) The Contractor shall install cold-rolled phosphor-bronze weatherstripping of the interlocking type on all exterior wood doors and windows. The open edge and tops of all exterior doors shall be equipped with interlocking strips of not less than 9 gage. The hinged edge of all doors shall be equipped with tongue type strips. The bottom of exterior wood doors shall have 12-gage, interlocking type strips and shall interlock with the door saddles. Where weatherstripping is called for on interior doors, the Contractor shall install 1-1/2-inch extruded bronze saddles. Material shall be similar and equal to that manufactured by the Chamberlain Metal Weatherstrip Co., Pretex Weatherstrip Mfg. Co., or Monarch Weatherstrip Co.

(2) All strips shall be carefully and accurately applied with nails, screws, or anchors of the same metal used for weatherstripping. All measurements shall be taken at the building, and all strips accurately fitted. All bare wood exposed after strips are applied shall be touched up with stain or paint as required.

h. Finish hardware. - Finish hardware shall be installed under this specification. Before acceptance, locks shall be tested, knobs tightened, and all adjustments made to leave the hardware in perfect working order. All hardware, as listed below, unless otherwise noted, shall be similar and equal to P. & F. Corbin Co., of New Britain, Connecticut. All locks shall be master-keyed.

(1) Casement windows (steel). - See Paragraph TP7-8 c (2).

(2) Projected steel sash. - See Paragraph TP7-8 b (2).

(3) Screens. - See Paragraph TP7-8 c (3).

(4) Casement sash (wood). -
Casement adjuster; DB-43-1/2, size as required.
Fastener; solid bronze, DB-2179-S.
Butt hinges; solid bronze, 2-1/2" x 2-1/2", DB No. 111.

(5) Full-height screens (wood). -

Butt hinges; solid bronze, 2" x 2" DB, No. 111.
Fasteners; solid bronze, DB-02169R.

(6) Screen doors. -

Hinges; brass, [illegible]-152-1/4 Stanley, or equal.
Catch; brass, EA 02459.
Push bar; brass, EA-2203, 3/4-inch.

(7) Exterior doors (wood). -

(a) Door No. 7, Men's Toilet:

1-1/2 pairs butts; solid bronze, DB-280, 4-1/2" x 4-1/2".

1 lockset; bronze, DB-850-870.

1 door check; No. 4 KB.

(b) Door No. 12, Women's Toilet:

Same as for Door No. 7, Men's Toilet.

(c) Door No. 3, Storeroom:

Same as for Door No. 7, Men's Toilet.

(d) Door No. 2, Stair Hall:

Same as for Door No. 7, Men's Toilet.

(e) Door No. 17, to Bar Screen Chamber:

1-1/2 pairs butts; solid bronze, DB-280, 4-1/2" x 4-1/2".
1 lockset; bronze DB-840-870.
1 door check; No. 4 KB.
1 door stop; solid bronze, DB-0372-1/2, 6-inch.

(8) Interior doors (wood). -

(a) Door No. 8, Men's Toilet:

1-1/2 pairs butts; solid bronze, DB-280, 4-1/2" x 4-1/2".
1 door pull and plate; solid bronze, DB-4484.
1 push plate; solid bronze, DB-2332, 12" x 3".
1 door check; No. 3 KB.
2 kick plates; solid bronze, DB-2314, size as required.

(b) Door No. 13, Women's Toilet:

Same as for Door No. 8, Men's Toilet.

(9) Hollow metal doors. -

(a) Door No. 11, Toilet No. 1:

1-1/2 pairs butts; solid bronze, DB-290, 4-1/2" x 4-1/2" TMS.
1 lock; bronze, DB-8303, TMS.
1 pair door knobs and roses; bronze, DB-1419 PY.
2 kick plates; solid bronze, DB-2314, size as required.

(b) Door No. 9, Toilet No. 2:

Same as for Door No. 11, Toilet No. 1.

(c) Door No. 15, Engine Room (to Office):

1-1/2 pairs butts; solid bronze, DB-290 - 4-1/2" x 4-1/2" TMS.
1 latch set; bronze, DB-8510 TMS.
1 pair door knobs and roses, bronze, DB-1419 PY.
1 door stop DB-0369-1/2.

(d) Door No. 18, Engine Room (to Screening Chamber Stairway):

1-1/2 pairs butts; solid bronze, DB-290 - 4-1/2" x 4-1/2" TMS.
1 latch; bronze, DB-8510 TMS.
1 pair door knobs and roses; bronze, DB-1419 PY.

(e) Door No. 16, Stair Hall (First Floor):

1-1/2 pairs butts; solid bronze, DB-290 - 4-1/2" x 4-1/2" TMS.
1 lock; bronze, DB-6431 TMS.
1 pair door knobs and roses; bronze, DB-1419 PY.
1 door stop; bronze, DB-0369-1/2.

(f) Door No. 10, Utility Room:

1 pair butts; solid bronze, DB-290 - 4-1/2" x 4-1/2" TMS.
1 lock; bronze, DB-6121 TMS.
1 pair door knobs and roses; bronze, DB-1419 PY.

(g) Door No. 6, Men's Toilet (from Storeroom):

1-1/2 pairs butts, solid bronze, DB-290 - 4-1/2" x 4-1/2" TMS.
1 lock; bronze, DB-6122 TMS.
1 pair door knobs and roses; bronze, DB-1419 PY.

(h) Door No. 4, Janitor's Closet (Men's Toilet):

1-1/2 pairs butts, bronze, DB-290 - 4-1/2" x 4-1/2" TMS.
1 lock; bronze, DB-6121 TMS.
1 pair door knobs and roses; bronze, DB-1419 PY.

(i) Door No. 14, Janitor's Closet (Women's Toilet):

Same as for Door No. 4 in Men's Toilet.

(j) Door No. 21, Stair Hall:

1-1/2 pairs butts; solid bronze, DB-290, 4-1/2" x 4-1/2" TMS.
1 latch; bronze, DB-8510 TMS.
1 pair door knobs and roses; bronze, DB-1419 PY.
1 door stop; bronze, DB-0369-1/2.

(k) Door No. 20, Pump Room:

1-1/2 pairs butts; solid bronze; DB-290, 4-1/2" x 4-1/2", TMS.
1 lock; bronze, DB-6431 TMS.
1 pair door knobs and roses; bronze, DB-1419 PY.
1 door stop; bronze, DB-0369-1/2.

(l) Door No. 22, Storage Room:

1-1/2 pairs butts; solid bronze, DB-290 - 4-1/2" x 4-1/2" TMS.
1 lock; bronze, DB-6121 TMS.
1 pair door knobs and roses; bronze, DB-1419 PY.
1 door stop; bronze, DB-0369-1/2.

(m) Door No. 23, Boiler Room:

1-1/2 pairs butts; solid bronze, DB-290 - 4-1/2" x 4-1/2" TMS.
1 lock; bronze, DB-6431 TMS.
1 pair door knobs and roses; bronze, DB-1419 PY.
1 door stop; bronze DB-0369-1/2.

(n) Door No. 19, Screening Chamber:

1-1/2 pairs butts; solid bronze, DB-290, 4-1/2" x 4-1/2" TMS.
1 latch; bronze, DB-8510 TMS.
1 pair door knobs and roses; bronze DB-1419 PY.
1 door stop; bronze, DB-0369-1/2.

(o) Door No. 24, Boiler Room:

1-1/2 pairs butts; solid bronze, DB-290 - 4-1/2" x 4-1/2" TMS.
1 lock; bronze, DB-6121 TMS.
1 pair door knobs and roses; bronze, DB-1419 PY.

(10) Door No. 25, Access Space. -

2 pairs butts; solid bronze, DB-290, 3" x 3" TMS.
1 chain bolt; bronze, DB-1259-1/2, 4-inch.
1 spring bolt; bronze, DB-0149-1/2, 4-inch.
2 pulls; bronze, DB-1789.

(11) Door No. 5, Store Room (Wood). -

2 pairs tee hinges; 51-inch, wrought iron, as detailed.
1 pair tee hinges; 27-inch, wrought iron, as detailed.
2 door pulls; 95087, wrought iron.
2 lever handles; bronze, DB-2122.
1 lock; bronze, DB-4580.
1 door holder No. 3.
1 chain bolt; bronze, DB-4252-1/2; 8-inch; chain, length as required.
1 bottom bolt; bronze, DB-1268

(12) Door No. 1, Engine Room. -

Adjustable ball-bearing pivot hinges:
1 pair bottom; bronze, DB-323.
1 pair top, bronze, DB-321.
2 pairs intermediate, bronze, DB-322.
1 lock; bronze, DB-4580.
2 drop handles; bronze, 11-D-1619 - Russell & Erwin, or equal.
2 lever handles; bronze, DB-2122.
1 chain bolt; bronze, DB-4252-1/2, 8-inch, chain length as required.
2 cane bolts - bronze, DB - Type 267.

(13) Wood Toilet Stall Doors (10 required). -

Spring hinges; CR-596 x 0596.
Door latches; CR-590 (hand as required).
Adjustable strikes; CR-671-1/2 (hand as required).
Coat hooks; CR-2421.
Pulls; CR-1791-1/2.

(14) Ceiling Scuttle (metal covered door - first floor stair hall). -

1 pair butts; bronze, DB-290 - 3" x 3".
1 door pull; bronze, DB-1789.

(15) One bronze-tipped window pole 10 feet long with bronze wall hanger.

TP7-5. ROOF PLANK. - a. General. - The Contractor shall erect the roof plank for all roof areas, cants, etc., as shown on the drawings, as herein specified, or as directed by the Contracting Officer.

b. Materials. - (1) Roof plank shall be similar and equal to the following products: "Steel-bound Gypsteel Senior Plank" manufactured by Certainteed Products Corp., "Long Span Gypsum Plank" manufactured by U. S. Gypsum Co., or equal. The material shall be of the "long span" type 2 inches thick, bound and reinforced on the sides and end by tongued and grooved galvanized steel channels, 2 inches deep.

(2) The Contractor shall submit samples of the materials for approval by the Contracting Officer before installation.

c. Installation. - (1) Steel-edged, tongue-and-groove, long-span gypsum plank shall be laid up on the purlins with close joints, and with ends staggered in adjacent rows starting with alternate full and fractional lengths. Each plank shall be anchored to the purlins with special heavy-duty galvanized steel clips.

(2) The plank shall be neatly cut for protruding pipes, etc., and the surface of the plank shall be left smooth and even to receive the roofing material. Cants, crickets, etc., shall be constructed of the same materials as the roof planking.

TP7-6. ROOFING AND SHEET METAL WORK. - a. General. - The Contractor shall perform all roofing, sheet metal, and cast lead and hard lead gutter and leader work as shown on the drawings, as herein specified or as directed by the Contracting Officer.

b. Materials. - (1) Slate shall be non-fading first-quality Vermont split-face roof slate, 30 per cent tan, 30 per cent green, 20 per cent purple, 20 per cent black, in widths varying from 6 to 12 inches. All slates shall be quarry-punched for nailing. Exposures and thicknesses shall be as follows:

1 inch thick, covering the first quarter of the slope, laid 10 inches to the weather.

3/4 inch thick, covering the second quarter of the slope, laid 8 inches to the weather.

1/2 inch thick, covering the third quarter of the slope, laid 6 inches to the weather.

3/8 inch thick, covering the top quarter of the slope, laid 4-1/2 inches to the weather.

(2) Sheet copper shall be 16-ounce conforming to the requirements of Federal Specification QQ-C-501a, Class A or Class B, as applicable.

(3) Lead-coated copper shall be 16-ounce copper sheets with a lead coating on each side of the sheet of not less than a total of 28 pounds per 100 square feet for ornamental exposed work, and 12 to 15 pounds per 100 square feet for flashings and concealed work. Lead coating shall be applied by the hot-dip process. Coating by electrolytic process will not be accepted. Unless otherwise specifically called for or indicated, all ornamental exposed sheet copper used in the work shall be lead-coated with finish not rougher than Ledkote "Old English", as made by Ledkote Products Company, Long Island City, New York, or equal.

(4) Hard lead ornamental gutters, leader-heads and straps shall be similar and equal to that manufactured by Ledkote, Hoyt, or Henry Hope & Sons, or equal, and shall be of the sizes, contours, and patterns as detailed.

(5) Tin for tinning seams for soldering shall conform to Federal Specification QQ-T-371, Grade A.

(6) Solder shall conform to the requirements of Federal Specification QQ-S-571a, Class A. Flux for soldering shall be non-oxidizing and non-corrosive and shall be either rosin or an approved brand of soldering paste. (See Federal Specifications O-F-506 and LLL-R-626.)

(7) Elastic cement shall conform to the requirements of Federal Specification SS-C-153.

(8) Nails shall conform to the applicable requirements of Federal Specification FF-N-101. Nails used for fastening copper shall be hard copper or yellow metal nails and not smaller than No. 15 Stubbs gage and of length sufficient to penetrate 1-1/4 inches into the roof planking. All other nails shall be of rust-resisting materials. Nails for roof slate shall be copper or yellow metal cut nails and shall penetrate into the roof plank 1-1/2 inches.

(9) Screws and bolts for fastening non-ferrous metal work shall be of bronze, copper or brass as required.

(10) Asphalt-saturated felt shall be similar and equal to No. 45 Johns-Manville, 50 pound asphalt-saturated rag felt.

(11) Asphalt primer shall conform to the requirements of Federal Specification SS-A-701.

(12) Asphalt for hot application shall conform to the requirements of Federal Specification SS-A-666.

c. Workmanship. - (1) Sheet metal roofing. - Surfaces to be covered with sheet copper shall be free from all defects which may result in damaging the roofing, or impair proper drainage. All surfaces shall be cleaned of dirt, rubbish, and other foreign materials before and during the progress of the work.

(2) Seams. - (a) Standing seams, where shown on drawings, shall finish not less than 1 inch high with the locked portion of the seam 3/8 inch high and 5 plies in thickness. All seams shall be flat locked seams and finish not less than 1/2 inch wide. All flat seams shall be made in the direction of the flow.

(b) Double locked seams shall be turned up 1-1/2 inches at the edges and shall be folded over with the edge of the adjoining sheet three complete turns so that the finished seam shall be 6-ply and shall finish 1/2 inch wide. The seams shall be soldered down.

(b) Batten seams shall be constructed with 1-1/2" x 1-1/2" chamfered wood battens, cleated and lapped as shown on the drawings. Cleats shall be not less than 1-1/2 inches wide, spaced 12 inches on centers, nailed to the battens and of suitable lengths to engage all locking of the roofing when hammered flat.

(d) Loose-locked seams shall be made on intersections of roof planes or where an abrupt change of roof slope occurs. Such seams shall be unsoldered, hammered flat, double-lock seams. The seams shall be placed as close to the intersection as possible, and shall be formed to preclude leakage. The sheet metal shall not be fastened to the roof, except that at the cross seams of the sheet so joined, cleats may be set close to the intersection of the seams.

(e) Cleats. - Sheets over 12 inches wide shall be fastened with cleats 1-1/2 inches wide by approximately 4 inches long, spaced not more than 8 inches apart. Where used with soldered seams, the cleats shall be tinned. Except as otherwise required, one end of the cleat shall be locked into the seam, the opposite end fastened to the roof with nails and the end of the cleat turned back over and completely covering the nail heads. The cleats shall be of the same materials as the sheet metal which they connect.

(f) Flat seam roofing shall be formed of sheets not larger than 18" x 24", laid in horizontal courses of the narrower dimension and shall have all vertical seams staggered. All sheets shall be properly notched and bent to form flat-locked and soldered seams.

(g) Roofing felt. - All roofing surfaces shall be covered with one ply of roofing felt with seams well lapped and nailed on as specified under subparagraph c (11) (b) below.

(3) Flashings. - (a) Eaves and rakes. - Flashing shall be installed along eaves and rakes of pitched roofs as shown on the drawings. The flashings, in general, shall be of full-length sheets 96 inches long, shall lap on the roof surface not less than 8 inches and the apron shall extend down into the gutter or over the fascia.

(b) Valleys. - Flashings shall be installed in the valleys of all pitched roofs. The flashings shall be made with sheets as long as possible, with cross seams lapped and with no longitudinal seams. The flashings shall have their edges turned back 1/2 inch and secured in place with cleats on both sides, spaced not more than 12 inches apart and locked into the folded edge. On sheet metal roofs the edges of flashings shall lock with the roofing sheets to form a watertight joint. On slate roofs the edges of the flashing shall extend under the slate not less than 6 inches. A V-ridge, one inch high, shall be provided at the center line extending the full length of the valley.

(c) Through wall flashing shall be of 16-ounce lead-coated copper formed into dovetailed shaped flat corrugations or undercut saw-tooth ribs which shall provide a mechanical key bond in three directions (longitudinal, vertical and transversal). Crimped copper or deformed sheets that provide bond only in a horizontal direction will not be accepted. The use of attached members, either riveted or soldered to the flashing sheets will not be permitted, and the metal shall not be broken or perforated in any manner. The flashings shall be set in a bed of mortar and shoved into place in a manner that the mortar will fill all the deformations in the copper. The keys or ribs shall extend transversely for drainage. The flashings shall be so formed as not to cause any accumulation of water on the horizontal surfaces. The flashing shall extend through the wall to within one inch of the exterior face of masonry. End joints shall be interlocked in such a manner that they will make them watertight. The flashing shall be turned up 2 inches around all chases and columns. The above shall be used at the roof against all parapets and adjoining higher walls. The flashing shall follow the slope of the roof in coping joints and reglets, as required.

(d) Flashing over windows and doors. - Heads of windows and doors, except where protected by porches, shall be flashed with lead-coated copper for the full length of the lintels. The flashing shall be formed over the top of the lintel, turned up one inch on the inner surface of the wall and be finished with a folded drip over the lintel and the ends of the flashing shall be folded. Flashings over

arched windows or doors shall be on a level line as close as possible to the top of the arch.

(e) Flashing over expansion joints. - Where membrane waterproofing is required at expansion joints, except at angles, the joints shall be covered with 16-ounce, hot-rolled plain copper 12 inches wide.

(f) Flashing of pipes through roofs. - Pipes projecting through roofs shall be flashed with lead weighing 6 pounds per square foot. The flashing shall consist of a base not less than 20 inches square to which shall be soldered a lead tube extending 8 inches above the roof line. Over the base tube, a cap tube shall be turned over the pipe top and extended down over the base tube not less than 4 inches. Sufficient clearance shall be allowed between the pipe and lead flashing to allow freedom of movement, expansion and contraction. Flashings on pitched roof shall be secured to the roof construction and built in with roofing materials.

(g) Flashing of half-timber work shall consist of 16-ounce, lead-coated copper on all unexposed surfaces of the timbering and shall be installed in such a manner that it will shed water.

(4) Reglets. - Sheet metal flashing of stonework shall finish in reglets in masonry 1-1/2 inches deep only where so detailed. The sheet metal shall be turned into the reglet the full depth and turned back to form a hook. After the sheet metal is in place, the reglets, on vertical surfaces or on surfaces having a slope of more than 60 degrees, shall be completely filled and calked flush with lead wool. On horizontal surfaces or surfaces having a slope less than 60 degrees, the reglets shall be calked with lead-wool plugs located at maximum of 18-inch centers and pointed with elastic cement. Lead-wool plugs shall be 1-1/2 inches wide.

(5) Gutters. - (a) Molded gutters shall conform to the size and design shown on the drawings, and shall be cast lead in 6- or 8-foot lengths. They shall have a flange which shall extend up on the roof and be flat-locked to the roof sheets or eaves flashing and shall be held in place by cleats 30 inches apart. The outer edge of the gutters shall be stiffened by a flat brass bar, 1" x 1/8", and shall be provided with a proper drip. Braces of lead-coated copper, 1" x 1/8", shall be bolted to the stiffening bar and secured to the roof by two lead-coated brass screws. These shall be placed before the roof sheets are laid and shall be made watertight by a special cap soldered to the roof sheets and extended over the braces. These gutters shall have an inside lining of copper pitched to drains. Joints of moulded gutters shall be lapped 1 inch, secured with rivets and soldered.

(b) Hung gutters shall be constructed of 16-ounce hard (cornice temper) lead-coated copper, shall be in 8- or 10-foot lengths and shall be joined by 1-inch lapped, soldered, or slip joints,

with joints made in the direction of the flow. The gutters shall be 5 inches wide unless otherwise shown and the outer edge shall be rolled with a 1/2-inch diameter bead. Gutters shall be provided with end pieces, and caps, outlet tubes, and miters as required. Gutters shall be supported by 1/4-inch thick lead-coated cast bronze hangers, spaced not over 24 inches apart. Hangers shall be of the design and sizes as shown on the drawings, secured by brass lag screws where attached to wood and by brass expansion bolts where attached to masonry.

(6) Outlet tubes and goosenecks. - Outlet tubes shall be of 16-ounce lead-coated copper of a size to fit snugly into the leader and of sufficient length to extend into the leader not less than 3 inches. Tubes shall be formed with a single locked-and-soldered seam and shall have a lead-coated copper flange not less than 1 inch wide. This flange shall entirely encircle the tube, shall have all seams lapped with flow, and shall be well soldered. Flange shall be soldered to gutter lining. Goosenecks shall be made of cast lead and shall have no visible seams or joints.

(7) Screens formed of heavily leaded No. 14 copper wire, 1/2-inch square mesh, shall be provided for all gutters. The wire mesh shall be provided with frames of 16-ounce lead-coated copper folded over the ends of the wire and soldered to it. The screens shall be constructed in sections not over 10 feet long.

(8) Leaders. - Leaders shall be rectangular pattern and size as detailed, constructed of 16-ounce, hard (cornice temper) lead-coated copper, in 10-foot lengths, lapped, joints tinned inside and out and soldered. A 1-1/2-inch slip joint shall be provided for every 20 feet of leader. The work shall include all necessary elbows, offsets, etc., as required. Leader straps shall be cast lead.

(9) Drips. - Sheet metal work shall be finished along all edges of roofs, cornices, and similar work with a fold-over edge forming a drip. Where indicated or specified, drip edges shall be fastened by a continuous No. 12 gage, 1-1/2-inch wide brass strip, punched and countersunk for No. 12 brass wood screws, 1-1/2 inches long, spaced on 12-inch centers.

(10) Louvers. - (a) Louver frames with metal louvers and wire screens shall be installed as shown on the drawings. The frames shall be formed, over structural members, of hard (cornice temper) copper and shall be securely fastened in place to assure a weathertight connection between the louver and the wall.

(b) Screen cloth shall be No. 16 gage, (.063 inch diameter), 1/2-inch mesh copper or bronze wire. The screens shall be provided with bronze frames of channel or other approved section, not less than 1/8 inch thick and shall be fastened in place with brass screws.

(11) Slate roofing. - (a) Sample. - The Contractor shall set up a one-square sample of roofing for approval by the Contracting Officer prior to laying of the material. The approved sample shall be carefully preserved and closely followed in laying up of the roof.

(b) The entire roof area shall be covered with one ply of 50-pound roofing felt, nailed parallel to the eaves, with end laps of 6 inches and side laps of 3 inches. Roofing felt shall be doubled over all ridges and in valleys and shall be secured by nailing through copper discs on 18-inch staggered centers.

(c) Slates shall be laid with cut-copper or yellow metal nails, two nails to each slate up to 8 inches in width and 3 nails to slates wider than 8 inches. Nail holes shall be quarry punched, drilled and countersunk as required. Slating shall be started at the eaves with a cant strip and a double thickness of 1-inch slate. All slates in low roof pitches of roof and the runs of all valleys shall be laid in mastic cement. Slate shall be laid with a 3-inch headlap. Ridges shall be "Boston" style, for which special slates will be required. Voids shall be chinked in with pieces of slate and filled with mastic cement. All valleys shall be of the open type with each slate cut true to line. The width of the valley on each side shall be one inch narrower at the top than at the bottom.

(d) The Contractor shall install three rows of snowguards, at eaves over all entrances, at 18-inch staggered intervals. Snow guards shall be similar and equal to the product of Berger Brothers Co. of Philadelphia, Pa.

TP7-7. MISCELLANEOUS METAL WORK. - a. General. - The Contractor shall install and erect the various items of miscellaneous metal work required in the superstructure. The Contractor shall submit, for approval, detailed shop drawings and data descriptive of the work he proposes to install.

b. Materials. - The applicable provisions of Paragraph TP8-2 shall apply.

c. Steel stairs. - (1) Stringers shall be constructed of 10-inch, 8.4-pound channels, J. & L., or equal, placed and secured as shown on the drawings. Bracket angles for risers and treads shall be cold-riveted to the stringers and finished smooth on exposed faces. Rolled steel stock moulding shall be installed on the face of outside stringers and mitered at newels to form a moulded panel. Face stringers and mouldings shall be carried across well openings on landings to form a finish for floor construction, and shall be securely anchored to concrete headers.

(2) Newels shall be one-piece, 3-1/4" x 3-1/4" pressed square steel tubing of 3/16-inch minimum thickness, and rounded corners. Drops and caps shall be of cast iron of stock shape, as indicated on

the drawings. The newels shall be provided with all necessary clip and seat angles, lugs, brackets, etc.

(3) Treads and risers shall be of pressed steel of not less than No. 10 gage formed and shaped as shown on the drawings. The face of the risers shall have a pressed-in panel. The risers and treads shall be securely bolted to the seat angles with 3/8 inch stove bolts. Treads shall be filled with a 1 to 3-1/2 mixture of Portland cement and fine aggregate and with the cast iron abrasive-surfaced nosing, "Wooster" No. 103 or equal, 4 inches wide, anchored in the cement, as detailed. Cement fill shall have a wood-float finish with corundum particles trowelled into finish surfaces. Corundum particles shall be no larger than 1/8 inch in size and shall cover evenly and consistently not more than 40 per cent of the superficial surfaces.

(4) Stair railing shall consist of 1/2" x 1/2" mild-steel balusters, spaced on approximate 4-1/2-inch centers, and shall be shouldered or welded to top and bottom rails of 1" x 1/2" rolled-steel channels. The bottom rails shall be attached to the stringers with countersunk tap screws spaced not over 3 feet apart. The top rail shall have 1/4-inch drilled and countersunk holes spaced not over 2 feet apart for the attachment of wood hand rail.

d. Fireplace throat shall be "Covert", or equal, complete with smoke chamber and damper, and with lever handle operator through the face of the wall.

e. Mat sinkage frames shall be formed of 1" x 1" x 1/8" solid brass tees, brazed at the corners. The frames shall be bedded with cement-lime mortar allowing a 7/16-inch depression and the top of the tee flush with the adjacent floor finish.

f. Front plate for hydraulic valve housing shall be polished stainless steel, with etched inscription, as shown on the drawings.

g. Chain at outside posts and balustrade, where shown, shall be constructed of straight link, common coil solid bronze chain, 2-inch outside length, of 3/8-inch diameter stock, complete with hooks and plates anchored to the posts. One end of each chain shall be secured to the masonry by an ornamental bronze ring bolt.

h. Wrought iron. - The wrought-iron work shall include the walk gate, exterior hand rails and balusters, weather vane, ornamental strap hinges, ornamental iron bound for Engine Room Entrance Doors, ornamental chimney iron, and the strap members for the wood trusses. The weather vane shall be as selected by the Contracting Officer. All items of wrought iron work shall be constructed in accordance with the detail drawings.

i. All items of ferrous metal shall receive one shop coat of zinc chromate paint prior to delivery to the site and one field coat of blue lead paint following erection or installation in the work.

TP7-8. STEEL SASH. - a. General. - The Contractor shall install projected steel sash and domestic casement sash, as shown on the drawings and schedules.

b. Projected windows. - (1) Sash shall be "Truscon", commercial projected or equal, steel windows made from new billet steel. The frame members shall be of angle sections not less than 1-7/16 inches deep. The vent members shall be one-piece, hot-rolled angle sections not less than 1-9/16 inches deep, with integral weathering baffle providing closure contract with the frame member not less than 1/4 inch in contact width.

(2) Hardware. - The windows shall be equipped with pole-operated spring latches. The hardware shall be solid bronze, U. S. No. 10 finish.

c. Casement windows. - (1) Sash shall be "Truscon-Roto", residence type, or equal, steel casements set in wood frames. All members shall be constructed of low-carbon, new billet, hot-rolled steel of zee bars, mitered and electrically butt-welded.

(2) Hardware. - The windows shall be equipped with extension type steel hinges, bronze locking handles and loose-key, worm drive operator.

(3) Screens shall be designed for installing and removing from the inside of the building, shall be rewireable and shall have formed steel frames and 20-mesh bronze screen cloth and 1/4-inch mesh copper screening. Screens for steel sash will be required for window in Toilet No. 2 only.

d. Shop finish. - All steel sash shall be Bonderized and finished with a dip coat of gray phenol-resin paint, oven-baked for one hour at 300 degrees Fahrenheit.

e. Adjustment. - After setting the sash, but before glazing, all vents shall be carefully adjusted to insure proper alignment of vent and close continuous weathering contacts.

TP7-9. HOLLOW METAL DOORS AND FRAMES. - a. General. - The Contractor shall install hollow metal doors and frames as shown on the drawings and as herein specified.

b. Materials. - Doors and finished frames shall be constructed of best grade open-hearth, full cold-rolled, full-pickled, double-annealed, stretcher-leveled sheet furniture steel, entirely free from scale and pit marks, and of the U. S. Standard Gages specified.

c. Workmanship. - All work shall be produced to conform to the best accepted standards. All finished work shall be smooth and free from warps and buckles. All mitres and mouldings shall be well formed

and in true alignment. All welded joints shall be ground smooth and weld marks shall not show when finished.

(1) Doors shall be 1-3/4 inches thick of paneled design as shown, with slightly beveled edges. Panels shall be two sheets of 18-gage steel separated by a heat-retarding filler. Stiles, rails, and muntins shall be of 18-gage steel, and separately formed mouldings shall be of 20-gage steel. Sound-deadening material composed of a cork strip, 1-1/2 inches wide, shall be placed in all rails and stiles. Removable mouldings shall be secured by countersunk, oval head screws. A 3/8-inch rabbet shall be provided for glazing where required. Doors shall be reinforced with 3/16 inch thick plates for butts, 6 inches longer than the butts, No. 12 gage metal for locks, and 1/8-inch metal for door checks. All drilling and tapping for hardware shall be performed according to templates to be furnished by the hardware manufacturor.

(2) Frames shall be of 16-gage steel with detachable trim where required, securely fastened, anchored as detailed, and with required reinforcements and mortises for hardware, according to template. Rough bucks shall be of 14-gage steel. Casings and scribe mouldings, where detailed, shall be of the detachable type, stock design, 18-gage metal, secured by concealed clips.

d. Finish. - All inside surfaces shall be thoroughly cleaned and coated with rust-inhibiting paint before fabrication. Exposed surfaces shall have all oil, dirt, or other impurities removed and be thoroughly sanded and cleaned. The exposed surfaces of doors and frames shall receive sufficient coats of mineral filler having each coat baked on and sanded to insure a smooth surface. All material, except rough bucks, shall have a coat of gray primer, baked on, ready for finish painting at the building.

e. Shop drawings. - The Contractor shall submit shop drawings for approval of the Contracting Officer.

f. Erection. - Rough bucks shall be erected prior to wall construction. Doors, finish jambs and trim shall be installed after walls are completed. All hollow metal work shall be kept covered and protected from damage until final acceptance of the building. All hardware shall be kept oiled and greased. Rough bucks shall be painted one shop coat and one field coat of zinc chromate paint.

TP7-10. GLASS AND GLAZING. - a. General. - The Contractor shall perform all operations in connection with glazing, as herein specified and as shown on the drawings. The sizes of glass to be installed at various locations shall be as follows:

(1) Polished wire plate glass shall be installed in the windows of the engine room and boiler room and shall be 3/4-inch square diamond pattern wired.

(2). Light colored smooth textured American cathedral glass shall be installed in all other sash throughout the building. Color shall be as selected by Contracting Officer.

b. Materials. - (1) Glass shall be similar and equal to that manufactured by Libby-Owens Ford Glass Co., Pittsburgh Plate Glass Co. or Mississippi Glass Company.

(2) Putty for sash glazing shall comply with Federal Specifications TT-P-791a, or TT-P-781a, of the type most suitable for the purpose.

c. Samples and lists. - The Contractor shall submit one light-size sample of each type of glass and a setting list for checking by the Contracting Officer prior to the installation of the glass.

d. Setting. - All glass shall be secured with either glazier points or clips. Glass for wood sash shall be well bedded with putty and calking compound for steel sash and shall be neatly and cleanly run with corners carefully made. Glass panels in doors and sash shall be guaranteed against rattling and any so left shall be reinstalled to the satisfaction of the Contracting Officer.

e. Acceptance. - All glass shall be protected against damage. All broken or imperfect glass, in the course of the work, shall be removed and replaced at completion of the building without additional expense to the Government. Upon completion of the building all glass shall be cleaned of all soil and paint and shall be washed and polished on both sides.

TP7-11. FURRING, LATHING, AND PLASTERING. - a. General. - The Contractor shall perform all operations in connection with metal furring, lathing and plastering as herein specified and as shown on the drawings.

b. Materials. - (1) Furring. - (a) Runner channels shall be 1-inch or 1-1/2-inch cold-rolled steel channels.

(b) Hanger straps shall be 1" x 3/16" flat steel hangers.

(c) Furring channels for walls, where shown, and ceilings shall be 3/4-inch or 1-inch cold-rolled steel channels, as shown.

(2) Metal lath shall conform to the requirements of Federal Specification QQ-B-101c, Type F3/8R, 3.4 pounds per square yard, for ceilings and Type FR for marble work and Type F for plaster surfaces for walls.

(3) Gypsum plaster shall conform to the requirements of Federal Specification SS-P-402, Type N.

(4) Calcined gypsum (Plaster of Paris) shall conform to the requirements of Federal Specification SS-G-901.

(5) Keene's cement shall conform to the requirements of Federal Specification SS-C-161, Type I or II.

(6) Lime. - (a) Hydrated lime shall conform to the requirements of Federal Specification SS-L-351, Type F, finishing.

(b) Quicklime shall conform to the requirements of Federal Specification SS-Q-351. Quicklime shall pass a No. 20 sieve and at least 90 percent shall pass a No. 50 sieve. Only one brand shall be used throughout the work.

(c) Lime putty shall be prepared of either hydrated lime or quicklime. Hydrated lime putty shall be prepared by mixing the hydrated lime with water to form a putty and stored in such a manner as to prevent evaporation for 24 hours. Quicklime putty shall be prepared by slaking the quicklime with enough water to make a cream, then passed through a No. 10 sieve, and stored in such a manner as to prevent evaporation for at least 14 days.

(7) Sand shall be clean, hard, free from loam, silt or other impurities, and shall be well-graded within the following limitations:

Sieve No.	Per Cent Passing by Weight
4	100
8	80 - 98
16	60 - 90
30	35 - 70
50	10 - 30
100	2 - 10

(8) Water shall be clean, fresh, and free from oils, acids, alkali, vegetable, organic or other deleterious matter.

(9) Wire shall be No. 16 gage galvanized annealed wire.

c. Workmanship. - (1) Furring and lathing. - All ceilings shall be lathed with 3/8-inch rib lath where required. Flat steel hangers shall be installed on 12-inch centers for suspended ceilings in Men's Toilet and shall be punched to receive the furring channels. Furring channels shall be wired, or secured with wire hairpin clips, to the straps, chord braces or to the walls on 12-inch centers. Metal lath shall be applied to furring channels. Exterior walls shall have horizontal runner channels spaced not more than 4 feet on centers and vertical furring channels spaced not more than 12 inches on centers. Furring shall be installed for all reveals, wide openings on interior

partitions, recessed doors, etc. Metal lath shall be installed with ribs at right angles to the furring and shall be secured with wire at 6-inch centers at all supports and at laps. Sides of sheets shall lap not less than 1/2 inch and ends not less than 1 inch. End laps shall occur only at supports. Metal lath shall be used to cover joints between frames and masonry, over soffits of steel lintels, across chases in masonry walls, etc. Where furred or lathed surfaces adjoin or form a continuation of brick, concrete or tile wall surfaces, the lath shall extend across and over the joints between surfaces not less than 4 inches for the entire length of the joints.

(2) Corner beads. - The Contractor shall install No. 24 gage galvanized narrow-nosed expansion corner or rail type bead at all external corners, vertical and horizontal, including door and window openings, except as noted. Corner bead shall be set straight, plumb and level, with no joints in any length less than 7 feet, and rigidly tied to supporting work with wire at 6-inch centers. Corner beads shall have expanded flanges not less than 2-1/2 inches wide.

(3) Plastering. - (a) Mixing. - Mixing of plaster shall be in accordance with the printed instructions of the manufacturer of the plaster used. Hand mixing boxes or a mechanical batch mixer of an approved type may be used for the mixing, and shall be cleaned after each batch and kept free of plaster from previous gagings. Plaster shall be mixed with the proper amount of water to obtain the uniformity of color and consistency of mass. Frozen, caked, or lumpy materials shall not be used. Mortar which has begun to stiffen shall be discarded. Retempering will not be permitted. Gypsum plaster for scratch coat shall be proportioned by weight as follows: One part of neat gypsum plaster to 2 parts of sand; and for the brown coat, one part of neat gypsum plaster to 3 parts of sand. The finish coat shall be composed of one part lime putty to 2 parts of sand gaged with calcined gypsum to the proper troweling consistency, or at the Contractor's option, smooth white Keene's cement may be used for the finish coat. Keene's cement shall be prepared and applied in accordance with the manufacturer's instructions.

(b) Application. - Plaster shall be applied in 3 coats to a minimum total thickness of 3/4 inch. Scratch and brown coats shall be carried to the floor between grounds, except behind marble wainscots or as otherwise shown. Ceilings shall be level and walls true, straight and plumb. Internal corners shall be square and external corners shall be worked to corner beads. The scratch coat shall be full and thick and shall be applied with sufficient force to form good uniform keying and embedment of the lath. The first coat shall be well scored and cross-scratched upon attaining initial set. The brown coat shall be applied immediately after the scratch coat with sufficient pressure to force plaster into scratches, built out to the grounds, rodded, darbied, floated to true even surfaces, and left sufficiently rough to provide a bond for the finish coat. The brown coat shall be allowed to set until practically air dry before applying the

finish coat. The surfaces of the finish coat shall be straight and true, with sharp, straight arrises, true angles, and free from trowel marks, checks and other blemishes. Keene's cement finish, if used, shall be applied in two thin coats over a thoroughly set but damp brown coat. The first coat shall be roughed-on with plenty of water and shall be doubled back with a slightly stiffer second coat, laid down tight and troweled to a smooth finish free from visible blemishes.

(c) Cutting and patching. - The Contractor shall carefully examine the work throughout the building upon completion, prior to painting, and all cracks, blisters, pits, checks, and other defects shall be cut out and patched with a special patching plaster of the same brand used in the work.

d. Cleaning. - Upon completion of the work, the Contractor shall remove from the premises all scaffolding, equipment, and rubbish resulting from the work. The entire work shall be thoroughly cleaned down at the completion and left in a condition satisfactory to the Contracting Officer.

TP7-12. TILE AND MARBLE WORK. - a. General. - The Contractor shall perform all operations in connection with tile and marble work in the building as shown on the drawings and schedules and as herein specified.

b. Materials. - (1) Tile. - (a) Quarry tile shall be similar and equal to "Murtico", manufactured by the Murray Tile Co. of Cloverport, Kentucky, of color selected by the Contracting Officer.

(b) Ceramic tile shall be unglazed, vitrified, solid color, of domestic manufacture, and of Selected Grade for interior floors subject to hard wear. The floor tile shall conform to the Simplified Practice Recommendation R61-30 of the U. S. Department of Commerce. The Contractor shall furnish the Contracting Officer with the Association Grade Certificate covering all tile before the tile is set. The labels on the containers of tile shall be marked to correspond with the marks on certificate and the containers shall be delivered to building site with the labels intact and packages unbroken. The tile shall be subject to inspection by the Contracting Officer before the containers are opened. All colors and patterns shall be as selected by the Contracting Officer.

(2) Marble. - Marble for toilet partitions and wainscots shall be domestic Napoleon Grey sound stock.

(3) Slate shall be 1 inch thick, clear, black Monson, Maine slate, or equal.

(4) Samples. - The Contractor shall submit samples of the tile and marble for approval by the Contracting Officer prior to installation.

(5) Accessories. - (a) Mirrors shall be 24" x 16" x 1/4" polished plate glass - Federal Specification DD-G-451, with chromium plated brass frames, 1-inch wide.

(b) Soap dispensers shall be "Ivory", wall type as manufactured by the Proctor & Gamble Co., or equal.

(c) Toilet tissue dispensers shall be A.P.W., No. 638, as manufactured by the A.P.W. Paper Co., Inc., Albany, N. Y., or equal.

c. Workmanship. - (1) Tile. - (a) Quarry tile shall be 6" x 6", 3/4 inch thick frost-proof domestic tile, laid in a bed of Portland cement mortar and pointed flush with mastic cement. Tile shall be neatly fitted around pipes, engine and gear unit bases, shall be laid to pitch in the direction of floor drains, and shall be carried under all radiators. Upon completion of the work, the Contractor shall thoroughly clean the tile work and maintain and protect it with building paper or a coating of sawdust until final acceptance of the building.

(b) Ceramic floor tile shall be approximately 2 inches by 2 inches and the thickness shall be in accordance with the recommendation of the Tile Manufacturers' Association. The tile shall be neatly set in a bed of Portland cement mortar. All joints shall be grouted with Portland cement grout, forced into the joints, sprinkled with dry cement and finished flush and true. Excess grout shall be cut off and wiped from the face of the tile set. Excess interstices or depressions found in the joints when the grout has been cleaned from the surface of the tile shall at once be roughened and filled to the proper line before the work is left for the mortar to harden. Tile shall be neatly fitted around pipes and plumbing fixtures and shall be laid to pitch in the direction of urinals and floor drains and shall be carried under all radiators. All work, protection of tile floor and protection of adjoining work shall be performed in a practical manner and in accordance with the "Basic Specification for Tile Work, K-300 Revised" and subsequent revisions thereto, as issued by the Tile Manufacturers' Association, Inc.

(2) Toilet partitions and wainscots. - Caps and stiles shall be 1-1/4 inches thick and wainscots and partitions shall be 7/8 inch thick. All exposed sides and edges shall be polished and arrises slightly rounded. Portland cement scratch coat shall be applied over metal lath for backing of marble wainscots. Marble shall be set in accordance with standard practice, properly anchored with plaster of Paris on approximately 10-inch squares and all joints regular and hair-line. Wainscots shall be brought down 1 inch below the finished floor level. Unless otherwise shown on the drawings, toilet partitions shall be supported with knee and angle supports at three points. Pinning, doweling, and screws shall be of non-ferrous and stainless type. All exposed metal work shall be chromium-plated on solid brass. Cutting and drilling required for the work of other trades shall be neatly and

carefully executed. Upon completion, the marble shall be cleaned of all stains and kept well waxed, maintained and protected until final acceptance of the building.

(3) Slate shall be clear black stock, with a hone finish on all exposed surfaces and minimum thickness of one inch for base and saddles. Slate saddles shall be placed at all interior door openings on first floor, shall have 1/4-inch radius at the top edges, and built-in surfaces shall be sawed. Slate saddles shall be set in Portland cement mortar. Upon completion the slate shall be thoroughly cleaned, oiled, and satisfactorily covered until final acceptance of the building.

(4) Accessories. - (a) Mirrors. - One 24" x 16" x 1/4" mirror shall be installed over each lavatory and secured with concealed hangers.

(b) One soap dispenser shall be installed over each lavatory, secured to a concealed disc in accordance with the manufacturer's printed instructions. The disc shall be held in position by lead expansion shields and brass screws, or brass toggle bolts.

(c) Toilet paper holders shall be secured "back-to-back" with through bolts or expansion shields and brass screws, as required.

TP7-13. MEASUREMENT AND PAYMENT. - a. Superstructure. - (1) Payment for constructing the superstructure, complete, in accordance with the drawings and specifications will be made at the contract price for Item 27, "Superstructure".

(2) All other work, below or outside the concrete base, indicated on the drawings as Item 27 shall also be included in the contract price for Item 27, "Superstructure".

(3) The sand beds, mortar, grout, tile, flagstone, paving brick, other materials and work required in the completion of the floors shall be included in Item 27. See Paragraph TP7-1 for construction to be performed under other items in connection with the superstructure.

b. Brownstone wall. - (1) Measurement. - Measurement will be by linear foot for the length of brownstone wall constructed in accordance with the drawings and the specifications. (See Paragraph TP7-1.)

(2) Payment will be made at the contract unit price for Item 28, "Brownstone Wall", and shall include all costs for constructing the wall above the concrete foundation, and the gateposts and chains between the gateposts. Electric wiring for the gatepost

fixtures will be paid for under Item 35, "Electric Light and Power System", and the electric fixtures for the gateposts will be furnished by the Government. Cement and concrete for the foundation of the wall will be paid for under Items 23 and 25. Excavation for foundation of the wall will be paid for under Item 4, "Common Excavation - Trench".

SECTION VIII. MISCELLANEOUS METALS (Items 29 and 30)

TP8-1. GENERAL. - All metals, unless otherwise specified, shall conform to applicable Federal Specifications and, when not covered thereby, to applicable A.S.T.M. Designations. All castings shall have the pattern or mark number cast on them. Unless otherwise authorized by the Contracting Officer, the scale weights of each casting or forging after machining shall be within 5 per cent of the weights as calculated from the dimensions specified or shown on the drawings. Castings shall conform, at the minimum section thereof, to the following dimensional tolerances: where embedded in concrete, to within 1/8 inch; where not embedded in concrete, to within 1/16 inch of the dimensions shown on the drawings.

TP8-2. MATERIALS AND WORKMANSHIP. - a. The articles included in Items 29 and 30, other miscellaneous materials, and all metal required in the work, except as otherwise specified, shall meet the requirements of the following specifications where applicable to the use intended:

(1) Structural steel. - Federal Specification QQ-S-741, Type I, Grade B, unless otherwise specified. Welding will be accepted only where specified or authorized, and approved only when done in accordance with the current requirements of the American Welding Society.

(2) Cold-rolled steel. - A.S.T.M. Designation A 108-36 for "Commercial Cold-Finished Bar Steels and Cold-Finished Shafting". Unless otherwise specified this material shall be used for rods, pins, keys, and similar parts.

(3) Hot-rolled steel for shafting, sleeves, stuffing box, and rollers. - A.S.T.M. Designation A 107-42 for "Commercial Quality Hot-Rolled Bar Steels".

(4) Machine steel. Same as for Hot-Rolled Steel.

(5) Steel, corrosion-resisting. - Federal Specification QQ-S-763a or QQ-S-766a, as applicable.

(6) Steel forgings shall be of hot-rolled, open-hearth steel forging bars conforming to A.S.T.M. Designation A 235-42 for Carbon Steel For General Industrial Use, Forgings, Class C.

(7) Steel castings. - Federal Specification QQ-S-681b.

(8) Iron castings, gray. - Federal Specification QQ-I-652, class as indicated. Tensile tests and chemical analysis will not be required.

(9) Malleable iron castings. - Federal Specification QQ-I-666a, Class A.

(10) Steel rail track and fittings shall be standard A.S.C.E. sections and shall conform to the A.R.E.A. standard specification for carbon steel rails.

(11) Chains and attachments. - Federal Specification RR-C-271a of Type A and Grade II unless otherwise specified.

(12) Bolts, screws and washers. - Federal Specification FF-B-571a and current standard practice, unless otherwise specified.

(13) Wrought iron bars and shapes. - Federal Specification QQ-I-686a, Grade B.

(14) Wrought iron pipe. - Federal Specification WW-P-441a.

(15) Cast iron soil pipe. - Federal Specifications WW-P-401 and WW-P-421, as applicable.

(16) Black steel pipe and fittings. - Federal Specifications WW-P-406, Class A, and WW-P-521b.

(17) Sheet copper. - Federal Specification QQ-C-501a, Soft.

(18) Zinc coatings (hot-galvanized). - Federal Specification QQ-I-716.

(19) Babbitt metal. - Federal Specification QQ-M-161.

(20) Classes "C" and "D" bronze for slide gate seats shall be cast bronze made of the best grade of virgin metals, and shall have the following chemical composition:

Class "C" Bronze

Copper	82.00 to 83.00 per cent
Tin	6.75 to 7.50 per cent
Lead	4.50 to 5.00 per cent
Zinc	5.00 to 6.00 per cent

Class "D" Bronze

Copper	82.00 to 83.00 per cent
Tin	4.75 to 5.50 per cent
Lead	7.75 to 8.25 per cent
Zinc	4.00 to 5.00 per cent

(21) Lead. - Federal Specification QQ-L-171, Grade A.

(22) Solder. - Appropriate Federal Specifications QQ-S-551 and QQ-S-571a, as applicable.

(23) Valves. - Federal Specifications WW-V-58 and WW-V-76b.

(24) Structural aluminum. - Alloy 17S-T, Aluminum Company of America, or equal.

(25) Steel reinforcement. - Steel reinforcement shall be of new billet, intermediate grade, open-hearth steel, deformed, and shall conform to Federal Specification QQ-B-71a for "Bars, reinforcement, concrete, Type B, Grade 2, dated January 12, 1938." Certified copies of mill tests required shall be furnished by the Contractor, and the steel shall be subjected to such tests as the Contracting Officer may consider necessary to establish its quality, including particularly the requirements of bending and elongation.

b. Other items unless otherwise specified shall conform to current standard practice for the material required and use intended.

TP8-3. GALVANIZING AND PAINTING. - a. Galvanized iron or steel articles shall be galvanized by the hot-dip process unless otherwise permitted. Injuries to the galvanizing shall be satisfactorily repaired. Provision shall be made for protecting threads either by counterboring fittings to cover threads or by cutting threads to make a very loose fit before galvanizing, and carefully rerunning threads after galvanizing to leave a good coating over all threads. Hot-dip galvanizing shall be of such quality as to endure at least four 1-minute immersions in copper sulphate solution, in accordance with the requirements of the Preece Test.

b. Except as otherwise specified, all ungalvanized iron and steel to be exposed in the finished work shall be thoroughly cleaned and then thoroughly and evenly painted, in accordance with the applicable provisions of Section XVIII.

TP8-4. MISCELLANEOUS METAL (Item 29). - a. General. - (1) The Contractor shall install pipe trench and pit covers and frames, cleanout doors, ladders, manhole steps, area and floor gratings, steel stairs to the pump room, nosings for concrete stairs, angle iron brackets for hot water storage tank, ring bolts, gate steam housing, structural aluminum for gate stands, and other items of miscellaneous metal, as shown on the drawings. The Contractor shall submit for approval detailed shop drawings and data descriptive of the miscellaneous metal work he proposes to install.

(2) A rubberized gasket of special design, incidental to the installation of a cover in the pressure chamber, shall be installed. No separate payment will be made for the gasket, but it shall be included in the contract unit price for Item 29.

(3.) Steel stairs to boiler room, fireplace throat damper, mat sinkage frames, grilles, registers, chain, sidewalk doors and rubbish hoist, steel sash, wrought iron work and structural steel framing in the superstructure, catch basin and manhole covers and frames will be included in other items of the work.

b. Painting. - All items of miscellaneous metal shall receive one shop coat and one field coat of zinc-chromate primer and one field coat of blue lead enamel.

c. Payment will be made as specified in Paragraph TP8-6.

TP8-5. MISCELLANEOUS PIPE AND FITTINGS (Item 30). - a. Black steel or standard wrought iron pipe, complete with malleable iron fittings and connections, shall be installed on the structures where shown on the drawings. Pipe shall be of the size as shown on the drawings and shall conform to Federal Specifications WW-P-406 and WW-P-441a. Pipe fittings and connections shall be malleable iron conforming to Federal Specification WW-P-521b, of ball pattern and pin-connected where required; post connections at the floor and caps used on the bottoms of sleeves embedded in the concrete shall be standard screw type. All fittings shall be of Crane Company type or equal. Floor or wall flanges of screw type shall be anchored into the concrete with stud type expansion bolts or cinch anchors consisting of one primary and one secondary expansion unit similar and equal to that manufactured by the National Lead Company or the Ackerman-Johnson Company. The Contractor shall submit for approval detailed shop drawings and data descriptive of the miscellaneous pipe and fittings which he proposes to install.

b. All anchor bolts, sleeves, nuts and washers, required for the installation of equipment furnished by the Government, shall be included in this item of the work.

c. Payment will be made as specified in Paragraph TP8-6.

TP8-6. MEASUREMENT AND PAYMENT. - a. The quantities to be paid for will be the number of pounds respectively furnished and installed in accordance with the drawings and specifications. Whenever practicable, the quantities shall be determined by weighing the articles and materials on the most accurate scales available. The weight will be determined by the Contracting Officer, who may use, in his discretion, for that purpose, scale weights, railroad shipping weights, manufacturers' weights, catalogue weights or computed weights. The weight of all tare, packing and blocking will be deducted, using only net weights for payment quantities; provided that no payment will be made for any weight in excess of 5 per cent more than the computed weights as determined from the drawings.

b. In calculating computed weights, the following unit weights of the several materials will be used unless otherwise specified:

Structural Steel	- 0.2833 pound per cubic inch
Structural Aluminum	- 0.101 pound per cubic inch
Cast Iron	- 0.2604 pound per cubic inch
Wrought Iron Pipe	- The weight per linear foot shown in Table I of Federal Specification WW-P-441a.
Black Steel Pipe	- The weight per linear foot shown in Table I of Federal Specification WW-P-406.

c. Payment will be made at the contract unit price for Item 29, "Miscellaneous Metal", and Item 30, "Miscellaneous Pipe and Fittings", as applicable.

PART IV

SECTION IX. MECHANICALLY CLEANED BAR SCREENS (Item 31)

TP9-1. WORK INCLUDED. - The Contractor shall install two mechanically cleaned bar screens, complete in all details and ready for operation, in the locations as shown on the drawings or as directed by the Contracting Officer. Each mechanically cleaned screen shall consist of a bar screen, screen frame, channels set in concrete, cleaning device, drive mechanism with motor and magnetically operated motor starter, discharge hopper and three screening cans with covers.

TP9-2. MATERIALS. - All materials used in the construction of the mechanically cleaned screens shall be of the best quality and entirely suitable in every respect for the service required. All structural steel shall conform to the Federal Specification QQ-S-741 for Structural Steel. All iron castings shall conform to the Federal Specification QQ-I-652 and shall be of suitable class for the purpose intended. Other materials shall conform to applicable Federal Specifications.

TP9-3. BAR SCREENS. - The bar screens shall consist of bars not less than 3/8 inch by 2-1/2 inches in cross section, spaced with 1-1/2-inch clear openings between bars, with bars set straight and true and held firmly in place.

TP9-4. CLEANING RAKES. - The rakes for each mechanically cleaned screen shall be of sufficient width to clean the entire width of bar screen, and shall be cadmium plated, copper-bearing steel with milled teeth of cast steel or other approved material. The rakes shall be suitably reinforced and the teeth shall be not less than 3/4 inch thick and of such length to project 1-1/4 inches in the bars, and of suitable shape to thoroughly clean the screens without pushing material through the screens. Suitable provision shall be made for keeping the rake teeth in proper contact with the bars for complete cleaning, and without undue friction, to prevent the possibility of the rake jumping over unusually heavy accumulation of screenings on the bars.

TP9-5. CHAIN, SPROCKETS AND BEARINGS. - Chains for actuating the rakes shall be of approved material having the proper strength and durability for wear and attack from sewage. The chains shall be of the pintle type, of 6-inch pitch, with an ultimate tensile strength of not less than 30,000 pounds and average Brinell hardness of 170 to 200. Attachments shall be riveted in place with high-carbon, heat-treated, copper-bearing steel pins. Sprockets shall be of close-grained cast iron with chilled teeth and rim, and the teeth shall be ground to accurately fit the chain. Sprockets shall be split and bolted. Bearings shall be babbitt bearings at head shaft with industrial type fittings for pressure grease lubrication. Shafting shall be of cold-rolled steel. A take-up shall be provided at each upper bearing allowing for at least 6-inch movement. Bronze nuts shall be used for adjustments.

TP9-6. DRIVING MECHANISM. - The rake shall be powered by an electric motor through a suitable oil-immersed speed reducer of substantial design and suitable for the conditions of service. Shafts shall run on roller bearings and gears shall be enclosed in a heavy cast iron moisture- and oil-proof case. Where required, a shearing pin or other approved device shall be provided in the driving mechanism for protection against overload. The shearing pin or other device shall be readily accessible. Six spare shear-pins shall be furnished with each screen.

TP9-7. MOTOR AND MOTOR STARTER. - a. The motors for driving the mechanically cleaned screens shall be explosion-proof induction motors suitable for operation on 208-volt, single-phase, 60-cycle, A.C. power. Each screen shall be driven by its own motor. Each motor shall be of ample rating to drive the screen mechanism continuously with a rise in temperature not to exceed 55 degrees above an ambient temperature of 40 degrees Centigrade.

b. Each motor shall be provided with a combination magnetic reversing "across-the-line" type of explosion-proof motor starter. The starter shall be equipped with two thermal overload protection elements for each of the forward and reverse contactors, reset buttons in the cover, and heaters suitable for the motor furnished. The manually operated switch shall be unfused. The starter shall be equipped with explosion-proof push buttons for "Forward", "Stop" and "Reverse-Jog" operation and shall be connected for jogging action on the reverse only. Forward and reverse contactors shall be mechanically interlocked and equipped with low voltage release. The control shall be similar and equal to General Electric Company's Type CR7010, Size 1, NEMA type 7, complete with heaters.

TP9-8. HOUSING, HOPPER AND GUARD. - Proper guards shall be provided for sprockets, and housings shall be provided to the extent necessary to prevent splashing the adjacent floor by water from rake or screenings. Housings, hopper and sprocket guard shall be made of galvanized copper-bearing steel sheets not less than No. 12 gage thickness, or equal. Suitably and properly reinforced access doors shall be provided.

TP9-9. CANS AND COVERS. - The cans shall be watertight and approximately 20 inches in diameter by 24 inches high, of No. 12 gage galvanized steel, properly reinforced and fitted with lifting handles. Covers shall be provided for the cans, so designed that the joint between cover and can will be flyproof.

TP9-10. DESIGN. - The detailed design for the mechanically cleaned screens complete shall be such that all working parts will be readily accessible for inspection and repair, easily duplicated and readily replaced. Each and every part of the equipment shall be properly designed and suitable for the use and service required.

TP9-11. DRAWINGS. - The Contractor shall submit for approval detail drawings for the mechanically cleaned screens he proposes to install, in sufficient detail to check the design. These drawings shall include a complete and itemized list of all parts, with the grade and class of material or make of a standard article the Contractor proposes to furnish. The item number in the list of parts shall be shown on the drawings by means of a circle enclosing the item number and a solid light line connecting the circle to the part. Proposed construction shall be clearly shown on the drawings by the liberal use of sections, enlarged details or by other means. Any item or part needed to provide a complete and workable installation, in accordance with the intent of these specifications, shall be supplied by the Contractor whether or not the same is included on the drawings, the list of parts, or in the requirements of these specifications. Approved drawings submitted by the Contractor shall become a part of these specifications.

TP9-12. MATERIALS AND WORKMANSHIP. - Each screen with its accessories shall be constructed of the grade and class of materials as shown on the "List of Parts" on the design drawings as furnished by the Contractor and approved by the Contracting Officer, and the materials shall conform to the provisions of Paragraph TP8-2, where applicable. All anchor bolts, nuts, etc., shall be of corrosion-resisting steel. All metal workmanship shall be of approved standard quality.

TP9-13. INSTALLATION. - Each screen shall be completely assembled during installation. Care shall be exercised when drawing the frame up to the concrete to insure its being pulled against a true surface. All bolts shall be tightened carefully so as not to strain or warp the parts and to preserve proper alignment. Grout shall be poured between the face of the flange and the concrete to prevent any tendency to spring the frame.

TP9-14. INSPECTION AND TESTS. - a. The screens and accessories to be installed shall be assembled in the shop, as directed by the Contracting Officer, for inspection and to insure that all parts fit accurately and are in proper alignment.

b. After completion of the pumping station and the installation of all machinery, each screen shall be tested for satisfactory operation. Any adjustments in the setting or installation required to secure satisfactory operation of the screens shall be made by the Contractor. The screen motors shall be tested as directed and any adjustments or changes that may be required, in the opinion of the Contracting Officer, shall be made by the Contractor at no additional expense to the Government.

TP9-15. PAINTING. - a. All parts of the mechanically cleaned screens (except chains, sprocket teeth and bearings) shall receive one shop coat and one field coat of zinc-chromate primer, and two finish coats of graphite paint. Graphite paint shall be similar or equal to Detroit Graphite Company's Iron-Gard for underwater steel structures.

b. Motors and controls shall receive one shop coat and one field coat of zinc-chromate primer, and two coats of machine enamel (see Section XVIII).

c. Bearing areas of shafts, chains, sprocket teeth and all other surfaces which cannot be painted shall be coated with grease for protection during shipment and installation.

TP9-16. PAYMENT. - a. Payment for designing, furnishing, painting and installing the equipment and materials as specified herein will be made at the contract price for Item 31, "Mechanically Cleaned Bar Screens".

b. Partial payment up to 50 per cent of the contract price will be made when the equipment has been shop tested to the satisfaction of the Contracting Officer and delivered complete at the site of the work.

c. Final payment of the contract price will be made after the field tests are completed to the satisfaction of the Contracting Officer in accordance with Paragraph TP9-14.

d. The payment for all testing shall be included in the contract price for Item 31.

SECTION X. SLUICE GATES, COMPLETE WITH HOISTS (Items 32 and 33)

TP10-1. WORK INCLUDED. - The Contractor shall design and install three new 72" by 84" unseating pressure sluice gates, complete with electric motor-operated hoists, sleeves, anchor bolts and all accessories. The Contractor shall salvage and reinstall one existing 84" by 84" unseating pressure sluice gate, with electric motor-operated hoist and all accessories. This hoist is now equipped with a 220-volt, 2-phase, 60-cycle motor and control. The 220-volt, 2-phase motor and control shall become the property of the Government and shall be delivered by the Contractor to a place designated by the Contracting Officer. The Contractor shall install on this hoist a new 208-volt, 3-phase, 60-cycle A.C. motor, complete with control. The sluice gates, complete with motor-operated hoists shall be in accordance with the drawings and specifications.

TP10-2. SALVAGE AND REINSTALLATION OF EXISTING SLUICE GATE. - The Contractor shall use extreme care in salvaging the existing sluice gate, hoist, and all accessories which shall be removed when and as directed by the Contracting Officer. Any parts damaged or injured in the process of salvage and reinstallation shall be satisfactorily repaired or replaced by the Contractor at no additional cost to the Government. The Contractor shall furnish as a part of the reinstallation a new motor and control, all anchor bolts and nuts, electrical conduit and wiring necessary for a complete installation. The Contractor shall cut a 4 inch length off the end of the gate stem and rethread the gate stem. Anchor bolts and nuts shall be of stainless steel as herein specified. Reinstallation shall be accomplished as outlined in Paragraph TP10-14. Painting shall be as specified in Paragraph TP10-16.

TP10-3. DESIGN REQUIREMENTS. - The three new gates and hoists shall comply with the following tabulated requirements:

Gate Number	Gate Opening	Maximum Design Head (Unseating)	Maximum Operating Head
1	72" x 84"	20 feet	20 feet
2	72" x 84"	20 feet	20 feet
3	72" x 84"	40 feet	20 feet

TP10-4. GATE LEAF. - The gate leaf shall be of cast iron having a flat plate not less than one inch thick and shall be suitably reinforced with horizontal and vertical ribs. Bronze seat facings shall be driven into dovetail grooves machined in the face of the leaf. The leaf shall have a pocket cast in the center near the top, heavily reinforced by ribs into which shall be fitted a solid manganese-bronze thrust nut, threaded and keyed to the stem. The thrust nut shall be of ample size to take the thrust both ways. There shall be tongues on each side of the leaf extending the full length of the leaf and these tongues shall be accurately machined all over. The leaf shall be fitted with four side wedges on each side and with two top and two bottom wedges. The

side wedges shall be of solid manganese-bronze of the adjustable type, shall be provided with tongues on the back to slide in vertical keyways machined in the leaf, and shall be secured to the leaf by shouldered stainless-steel studs and bronze nuts. They shall have solid bronze adjusting bolts. The side wedges shall be machined on all bearing surfaces and shall make accurate contact with the bronze wedge facings attached to the guides. The top and bottom wedges shall be of solid manganese bronze and shall be of the adjustable type. The wedges shall be attached to the leaf by shouldered steel studs and bronze nuts and shall have solid bronze adjusting bolts. The wedges shall be machined on all bearing surfaces and shall make accurate contact with the wedge seats attached to the frame.

TP10-5. GATE FRAME. - The gate frame shall be of the standard flanged type having the rear face machined and drilled to attach to the concrete and the front face machined to take the sluice gate guides. The gate frame shall be specially designed and drilled to permit easy access to all anchor-bolt nuts after installation. The frame shall be of cast iron of ample section to prevent distortion and shall be cast in one piece. Bronze seat facings shall be driven into dovetail grooves machined in the front face of the frame. The front face of the frame shall be machined on the vertical sides to fit the guides and shall have holes drilled and tapped for the guide studs. Keys shall be provided between the frame and the guides to prevent lateral movement of the guides. The frame shall have two pads on the top and two pads cast on the bottom to carry the seats for the top and bottom wedges. These pads shall be machined and keyways cut in them and the wedge seats shall be securely bolted to them. The top and bottom wedge seats shall be of solid manganese-bronze machined on all bearing surfaces. They shall have tongues on the bottom to fit into the keyways in the pads on the frame, and shall make accurate contact with the top and bottom wedges attached to the leaf.

TP10-6. GATE GUIDES. - The guides shall be of cast iron of sufficient length so that not less than one-half of the leaf is within the guides when the gate is open. Slots shall be machined the full length of the guides of such dimensions that there is not over 1/16 inch clearance with the tongues on the side of the leaf. The guides shall be machined to fit the frame and shall be bolted to the frame with steel studs and keyed to the frame to prevent lateral movement. Holes for studs shall be spot faced. The guides shall be reinforced with heavy ribs at points of contact with the side wedges of the leaf, capable of taking the whole thrust due to water pressure and wedging action. Heavy bronze wedge facings shall be attached to the guides at points of contact with the side wedges. These wedge facings shall be machined on all bearing surfaces and shall make accurate contact with the side wedges.

TP10-7. GATE STEMS. - a. The gates shall have rising stems of sufficient size to withstand safely, without buckling, the whole thrust due to closing the gate under the maximum operating head. The stems shall be capable of withstanding the maximum thrust of the hoist. The gate

stems shall be of cold-rolled steel in sections not exceeding 10 feet in length. The sections of each stem shall be joined together by solid manganese-bronze couplings threaded and keyed to the stem.

b. Stem shall be provided with stem guides as indicated on the drawings so that the unsupported length of the stem will not exceed 10 feet. All stem guides shall be bronze-bushed and adjustable. Where the stem of gate No. 3 passes through the intermediate platform, the stem shall be provided with a watertight stuffing box.

TP10-8. ANCHOR BOLTS AND NUTS. - All sluice gate anchor bolts and nuts shall be made of stainless steel.

TP10-9. ELECTRIC HOISTS. - a. The gate hoists shall be electric-motor-operated, pedestal type, one for each of three gates as shown on the drawings, complete with electric motor and controls, stems, stem guides, stem pipe cover, torque plates, accessories and position indicator, and shall be sufficient in capacity to raise and lower the gates against the maximum operating head, at a raising and lowering speed of one foot per minute minimum (see Paragraph TP10-3). The two electric hoists in the screening chamber shall be equipped with explosion-proof electrical equipment.

b. The pedestal and gear case shall be constructed of high grade cast iron with provisions made for attaching stem cover to top cover plate. A suitable torque plate shall be provided at the base of the pedestal. Electric contactor cases and push button cases shall be cast as integral parts of the pedestal and shall have cast iron covers with machined and gasketed joints. The contactor cases and push-button cases on two of the hoists shall be explosion-proof type.

c. All gears shall be of steel properly designed for the service intended. The gear shafts shall be provided with bronze bushings. Gearing shall be enclosed in dust-tight casings and shall be so designed that it will not be necessary to run the gears in oil or grease. Spur gearing shall be used. The stands shall include automatic mechanical hammerblow devices or other apparatus to allow the motor to come up to speed before unseating the gate.

d. A handwheel with disconnecting handle connected to the stem by suitable gearing shall be provided for hand operation of each hoist. The handwheels shall not revolve when the hoists are electrically operated, and the motors shall be automatically prevented from starting when the hoists are being hand-operated, or when the "hand-motor" handles are in the "hand" position.

e. Suitable visual indicators shall be provided so that the exact position of the gates can be determined at all times.

f. The motor for each hoist shall be mounted on the hoist pedestal and all controls built in completely enclosed. Each

hoist motor shall be direct-connected through a train of spur gears and the motor shall be of the high-torque, high-slip, squirrel-cage induction type, 55 degrees Centigrade rise in 30 minutes. The motors shall be designed for operation on 208-volt, 3-phase, 60-cycle power and to operate at a speed of not over 900 r.p.m. The starting torque of the motors at rated voltage and frequency shall be not less than 250 per cent of full load torque. Motor insulation shall be impregnated with a special moisture-resisting compound. All motors shall be equipped with grease-packed ball bearings. Two of the motors and their controls shall be explosion-proof construction, the other motor and its controls shall be totally enclosed splash-proof construction. The hoists shall be equipped with all necessary starting, control and protective devices.

g. The controllers shall be of the full-magnetic reversing type, designed for across-the-line starting, and controlled by a three-button, push-button station, so that the gates may be raised, lowered, or stopped at any desired point in their travel. The controllers shall be provided with undervoltage and inverse-time-limit overload protection accomplished by suitable relays. Overload relays shall be of the automatic reset type. The limits of travel of the gate in both upward and downward directions shall be accurately determined by quick-break limit switches geared directly to the gate stems. The switches shall be designed to absolutely prevent "drift" or jamming of the gate. The switches shall be housed in oil-tight cases and shall be equipped with quick-break contacts with micrometer adjustment. Each hoist shall contain a motor contactor equipped with separate "open" and "close" contactor arms, mechanically interlocked, and provided with arc shields. The contactor shall be of ample size and rating to make and break the current required by the motor under all conditions. Push buttons shall be provided. The push buttons shall be clearly labeled "open", "close" and "stop". A pilot light shall be installed, indicating that the motor is ready to be operated. All electrical apparatus shall be installed, and internal connections shall be made by the hoist manufacturer. The wiring shall terminate at a suitably enclosed terminal board.

h. The hoist shall have a hoisting speed with the electric motor of not less than 1 foot per minute. A gate-position indicator shall be included on the hoists. The gate-position indicator shall be plainly visible from the push-button station.

i. Unless otherwise specified, all electrical materials, workmanship, and tests shall conform to the current standard rules, regulations, and specifications of the American Institute of Electrical Engineers and of the National Electrical Manufacturers Association.

TP10-10. FURNISHINGS AND FITTINGS. - a. The gate frames, guides and hoists shall be designed and constructed to provide a satisfactory method of fastening them securely to concrete or other supports during erection as shown on the drawings. All bolts, special tools, and other devices necessary to erect the gates, frames, guides, and hoists as shown on the drawings shall be furnished by the Contractor.

b. All bolts, nuts, screws, studs, pins, etc., shall be securely locked by satisfactory devices that will prevent loosening due to vibration.

TP10-11. DESIGN. - a. The detailed design for the sluice gates, hoists, and accessories shall be such that all working parts will be readily accessible for inspection and repair, easily duplicated, and readily replaced. Each and every part of the equipment shall be properly designed and suitable for the use and service required.

b. The design stress for any member or part of the material covered by these specifications shall not be greater than one-sixth of the ultimate strength of the material used.

TP10-12. DRAWINGS. - The Contractor shall submit for approval drawings for the sluice gates, hoists, and accessories he proposes to install in sufficient detail to check the design. The drawings shall include a complete and itemized list of all parts with the grade and class of material or make of a standard article the Contractor proposes to furnish. Proposed construction shall be clearly shown on the drawings by the liberal use of sections, enlarged details or by other means. Any item or part needed to provide a complete and workable installation in accordance with the intent of these specifications shall be supplied by the Contractor. Approved drawings submitted by the Contractor shall become a part of these specifications.

TP10-13. MATERIALS AND WORKMANSHIP. - Each gate, with its hoist and accessories, shall be constructed of the grade and class of materials as shown on the "List of Parts" on the design drawings as submitted by the Contractor and approved by the Contracting Officer, and shall conform to the provisions of Section VIII where applicable. All metal workmanship shall be of approved standard quality.

TP10-14. INSTALLATION. - Each gate shall be completely assembled during installation and the leaf shall be rigidly held in place against the seat by means of jack screws. Care shall be exercised when drawing the frame up to the concrete to insure its being pulled against a true surface. All bolts shall be tightened carefully so as not to strain or warp the parts and to preserve proper alignment. Non-shrinking grout made with cement, similar and equal to "Embeco" cement, as manufactured by the Masters Builders Company of Cleveland, Ohio, shall be placed between the face of the flange and the concrete to prevent any tendency to spring the frame. After installation, the jack screws shall be removed.

TP10-15. INSPECTION AND TESTS. - a. The gates, hoists and accessories to be furnished shall be assembled in the shop as directed by the Contracting Officer for inspection and to insure that all parts fit accurately and are in proper alignment. Each gate shall be opened and closed to insure proper operation.

b. After completion of the pumping station and the installation of all machinery, each new gate shall be tested for satisfactory operation by being raised and lowered several times for its full length of travel. Any adjustments in the setting or installation required to secure satisfactory operation and tight closure of the gates shall be made by the Contractor. The gate hoists shall be tested as directed and any adjustments or changes required, in the opinion of the Contracting Officer, shall be performed by the Contractor.

TP10-16. PAINTING. - a. Gates and gate guides shall be given one shop coat and one field coat of zinc-chromate primer and two finish coats of graphite paint. Graphite paint shall be similar and equal to Detroit Graphite Company's Iron-Gard for underwater steel structures.

b. Gate hoists shall receive one shop coat and one field coat of zinc chromate primer, one coat of filler, and two coats of machine enamel (see Paragraph TP18-2m). Color shall be as selected by Contracting Officer.

c. The existing sluice gate and hoist shall be thoroughly cleaned and properly prepared for painting. The gate and guides shall be given two coats of graphite paint as specified above. The hoists shall be given two coats of machine enamel as specified in subparagraph b above.

TP10-17. PAYMENT. - a. Payment for designing, furnishing, painting and installing the three new 72" by 84" sluice gates complete as specified herein will be made at the contract unit price for Item 32, "Sluice Gates, Complete With Hoists".

b. Payment for salvage and reinstallation of the existing sluice gate complete as specified herein will be made at the contract price for Item 33, "Salvage and Reinstallation of Existing 84" by 84" Sluice Gate and Hoist".

c. Partial payments up to 50 per cent of the contract price will be made when the three new sluice gates with hoists have been shop tested to the satisfaction of the Contracting Officer and delivered complete at the site of the work.

d. Final payment of the contract price for Item 32 will be made after the field tests are completed to the satisfaction of the Contracting Officer in accordance with Paragraph TP10-15.

e. The payment for all testing shall be included in the contract prices for Items 32 and 33.

PART IV

SECTION XI. HEATING AND VENTILATING (Item 34)

TP11-1. WORK INCLUDED. - a. The Contractor shall install and place in operation the steam heating, water heating, and ventilating equipment as shown on the drawings and as herein specified. The steam heating system shall be a return pump system consisting of steel boiler, oil burner unit, condensate pump, a 1000-gallon fuel oil storage tank, unit heaters located in the engine room and store room and radiators in the toilets and stair-hall, and shall include steam piping, valves, traps, control devices, and all accessories and appurtenances herein specified and as shown on the drawings. The ventilating equipment shall consist of blower for the ventilation of the engine room, blower with connecting duct work for exhausting air from engine room, blower with connecting duct work for exhausting air from the pump room and toilet rooms, and blower for forcing fresh air into the screening chamber. All piping and connections shall conform to local laws and regulations.

b. All electric wiring from outlet boxes or power supply outlets to heating and ventilating equipment such as blowers, oil burner, unit heaters, etc. and all control devices between power supply outlets and heating and ventilating equipment or on such equipment shall be included under Item 34. This item shall also include all thermostats. Wiring to power supply outlets shall be included under Item 35.

TP11-2. GENERAL DIRECTIONS. - a. All work shall be performed in harmony with the other work on the building and at such times as directed by the Contracting Officer. The drawings show the general arrangement of the boiler, heating units, piping, etc. Should conditions necessitate any rearrangement, the Contractor, before proceeding with the work, shall submit drawings of the proposed rearrangement to the Contracting Officer for approval. Before the installation will be accepted, the Contractor shall have put every portion of the work in first-class condition. All equipment necessary for the proper operation of the system shall be installed by the Contractor in accordance with manufacturer's recommendations and to the satisfaction of the Contracting Officer.

b. The Contractor shall submit for approval detailed drawings and data descriptive of the heating boiler, oil burner, feed water regulator, condensate pump, water heater, fuel tank, and piping which he proposes to install. The Contractor shall also furnish descriptive data on the unit heaters, radiators, traps, valves, ventilating fans, motors and controllers which he proposes to install.

TP11-3. PROTECTION. - All work and materials shall be protected at all times. The Contractor shall make good all damage caused either directly or indirectly by his workmen.

TP11-4. MATERIALS. - a. General. - All materials and equipment shall be in strict accordance with this specification, and shall be new and of the best grade and quality. All manufactured apparatus shall be standard catalogue products of reputable manufacture, and shall meet the approval of the Contracting Officer.

b. Federal Specifications. - Materials used shall conform to the requirements of the following Federal Specifications:

Article	Federal Specification
Insulating materials:	
Firebrick	HH-B-671b
Fire clay (for use with firebrick)	HH-C-451a, Class C
Magnesia; block, cement, and moulded pipe covering	HH-M-61
Asbestos packing	HH-P-46
Mineral or rock wool pipe covering	HH-P-386a
Metals:	
Inspection of metals	QQ-M-151a
Iron and steel sheets	QQ-S-636 and QQ-I-716
Pipe:	
Wrought iron, welded, black and zinc-coated	WW-P-441a
Pipe threads	GGG-P-351a
Copper tubing	WW-T-799
Fittings:	
Flange dimensions	WW-F-406a
Nipples; steel and wrought iron	WW-N-351
Fittings; cast iron (threaded)	WW-P-501a
Fittings; malleable iron (threaded), 150-pound	WW-P-521b
Accessories:	
Unions; malleable iron or steel	WW-U-531a
Valves, brass or bronze; angle and globe, 150-pound	WW-V-51
Paint:	
Asphalt; varnish	TT-V-51
Iron oxide paint	TT-P-31a

c. Material and equipment schedule. - Within 30 days after the date of receipt by him of notice to proceed, the Contractor shall submit to the Contracting Officer a complete schedule of materials and equipment proposed for installation. The schedule shall include catalogues, cuts, diagrams, and such other descriptive data as may be required by the Contracting Officer. If any items of material or equipment contained in the schedule fail to comply with the specifications, such items will be rejected. If, prior to the expiration of the 30-day period, or any duly authorized extension thereof, the Contractor fails to submit a schedule of acceptable

materials or equipment covering the rejected items, the Contracting Officer reserves the right to select such items. Such selection shall be final and binding upon the Contractor, and the items so selected shall be furnished and installed by the Contractor without change in the contract price.

TP11-5. BOILER. - a. General. - The boiler shall be similar and equal to "Pacific" No. 2982, arranged for automatic firing. The shell and firebox shall be of flange quality steel plate. Trimmings shall consist of a relief valve, safety valve, water column and gage glass, pressure gage, compression cocks and automatic controls as herein specified. The installation shall be in strict accordance with the manufacturers' recommendations and shall be located to allow adequate space for cleaning and maintenance. Name plates giving manufacturers' name, address, trade name and catalogue number shall be securely attached to each major item of equipment. A distributing agent's name will not fulfill this requirement. The boiler and all parts shall be tested by the Hartford Steam Boiler Inspection and Insurance Company.

b. Combustion chamber. - The boiler combustion chamber or furnace shall be constructed of firebrick in strict accordance with recommendations of the oil burner manufacturer and shall provide for complete and proper combustion without the necessity of constructing a pit below the level of the boiler room floor. The furnace shall be arranged to provide a maximum heat release of 30,000 B.T.U. per cubic foot per hour. The side walls of the furnace shall be not less than 4-1/2 inches and the rear wall not less than 9 inches thick. Wing walls shall be provided extending from the burner opening to tie in with the furnace side walls. Refractory walls shall extend to at least 6 inches above the bottom of the water leg. All firebrick shall be laid in fire clay. Adequate expansion joints at corners and intersections of wing walls with furnace side walls shall be provided. Allowance for expansion shall be 1/16 inch per running foot of wall. Target walls and ignition arches shall be provided as required for optimum burner performance. The floor of the furnace shall be constructed as shown on the drawings. The Contractor shall submit for approval detail drawings showing the proposed refractory furnace construction.

c. Boiler connections. - (1) Return (Hartford loop) connection. - The Contractor shall install a complete Hartford return connection at the back of the boiler and connect the returns from the building to same as shown on the drawings or as directed by the Contracting Officer.

(2) Cold water connection. - The cold water piping shall be 85 per cent red brass of iron pipe size, standard weight. Fittings shall be malleable pattern brass, iron pipe size. The cold water line shall be run to the boiler through a gate valve, strainer, check valve, and boiler water feeder, the last being nearest the boiler. Provision shall be made for by-passing the boiler water feeder to permit feeding the boiler manually. The connections shall be adequate for

make-up and for filling the system, and the entire assembly shall meet the approval of the Contracting Officer.

(3) Drains. - Drains, consisting of 3/4-inch brass hose bibbs, shall be installed at low points in the system and elsewhere as required by the Contracting Officer, for the convenient and thorough draining of the system.

d. Boiler blow-off. - The boiler blow-off shall be connected through a 1-1/2-inch blow-off valve and piped to the sump pit.

e. Boiler trim. - (1) The pressure gage shall be of an approved Bourdon spring type with a minimum dial diameter of 4-1/2 inches and a pressure range of 0 to 15 pounds per square inch. The gage shall be installed in such a manner as to be accessible and easily read. The gage shall be equipped with either an integral or separate syphon, and shall be connected to the boiler by means of brass pipe and fittings containing a shut-off cock.

(2) The safety valves shall be of the pop type set to open automatically and relieve steam at a gage pressure of 15 pounds per square inch. Safety valves shall comply with the latest requirements of the A.S.M.E., Boiler Construction Code.

TP11-6. SMOKE CONNECTIONS. - a. The boiler shall be connected to the flue by means of a smoke connection constructed of not lighter than No. 18 U. S. Standard gage galvanized iron or steel sheets. All iron sheets shall be true to form, free from laminations, laps, blisters, ragged edges or corners, or other defects which might affect their appearance or serviceability.

b. Suitable cleanouts shall be provided for cleaning the entire smoke connection without dismantling. Cleanout doors shall be provided with suitable hinges and clamps and with necessary gasket material for making a gas-tight joint.

TP11-7. DRAFT CONTROL. - The Contractor shall install in the smoke connection an approved barometric type draft regulator for the purpose of controlling and maintaining a constant draft in the boiler fire box, regardless of change in atmospheric conditions. The area of the opening in the draft regulator shall be not less than the area of the smoke connection.

TP11-8. CONDENSATE PUMPING UNIT. - a. General. - The condensate pumping unit shall be of the single, vertical shaft type, as shown on the drawings. The unit shall consist of pump, motor, and receiver, all mounted on a suitable cast-iron or steel base. The pump shall have a capacity not less than shown on the drawings, when discharging against the specified pressure. The pump shall be free from air binding, when handling condensate at temperatures up to 200 degrees Fahrenheit.

b. Construction. - The pump shall be of the centrifugal type, bronze-fitted throughout, with impeller constructed of bronze or other corrosion-resistant metal as approved. The receiver shall be made of cast iron and shall be provided with all the necessary reinforced threaded connections. The pump shall be connected directly to a suitable drip-proof motor. An enclosed float switch, complete with float and mechanism, shall be installed in the receiver.

c. Connections. - A gate valve and a suitable basket type strainer as specified in Paragraph TP11-19 shall be installed at the suction side of the pump.

d. Control. - The pump shall be controlled automatically by means of the float switch, which shall automatically start the pump motor when the water level in the receiving tank reaches the high point and shall stop the motor when the water level reaches the low point.

e. Motor. - The motor for the condensate pump shall be a 115-volt, single-phase, drip-proof capaciter type, with a thermal overload switch similar and equal to General Electric Company's type CR-1061-CIA with suitable heater.

TP11-9. OIL BURNER. - The oil burner shall be of the motor-driven, horizontal, rotary cup type, similar and equal to "Petro", Model P-12, and shall consist of a motor, fan, fuel oil pump, pressure regulating valve and horizontal rotary cup atomizer, with angular-vaned nozzle, all combined into one integral unit. The burner shall be capable of burning No. 3 oil of uniform and standard specifications. The unit shall mechanically atomize the oil and vigorously and thoroughly mix the oil vapor with the proper quantity of air. Excess air shall be kept within efficient limits and shall be supplied in carefully regulated quantities. The burner shall be provided with a means of interlocking the variable primary air control, secondary air intake damper and fuel metering valve. The burner shall be arranged for intermittent electric ignition. Operation of the burner shall be fully automatic. The burner equipment shall consist of pressure type burner, necessary refractories, piping, wiring, switches, together with automatic controls and accessories as required herein. The motor shall be provided with overload protection. The oil burner shall have sufficient capacity to develop not less than 125 per cent of the specified boiler capacity and shall be specially designed for efficient operation with the particular boiler selected.

TP11-10. FUEL TANK AND PIPING. - a. The fuel oil tank shall be a new 1000-gallon, welded steel tank, set on concrete supports underground and suitably anchored as indicated on the drawings. The fill line and vent line shall be of standard weight, galvanized, wrought-iron pipe with galvanized malleable-iron fittings. A vent cap shall be provided on the vent line and the fill pipe shall have a lock type fill connection. An oil level indicating device, similar and equal to Liquidometer "Junior", as manufactured by the Liquidometer Corporation, Long Island City, N. Y., shall be installed in conjunction with the oil storage tank.

The gage connections shall be inserted through a suitable steel conduit from the tank to a point inside the building, as indicated on the drawings. Only long bend conduit fittings shall be used.

b. Unless otherwise specified, the complete installation of the oil burner and all fuel oil piping materials, workmanship and tests shall be in conformity with local rules and ordinances and with the current standard rules, regulations and specifications of the National Board of Fire Underwriters, Chicago, Illinois and with the legal requirements of the City of Hartford.

TP11-11. PIPE AND FITTINGS. - a. Pipe. - All pipe not otherwise herein specified shall be standard weight, uncoated wrought-iron pipe.

b. Fittings. - Fittings shall be standard weight, cast-iron, beaded-pattern fittings designed for 150 pounds per square inch working pressure. Reducing fittings shall be bushed in the sand as bushings will not be acceptable.

TP11-12. PIPING DETAILS. - a. General. - All pipes shall be cut accurately to measurements established at the building by the Contractor and shall be worked into place without springing or forcing and out of the way of windows, doors, or other openings. Excessive cutting or weakening of the building structure to facilitate piping installation will not be permitted. All pipes, after having been cut, shall have all burrs removed by reaming. All changes in direction shall be made with fittings, except that bending of 2-inch and smaller pipe will be permitted, provided that a hydraulic pipe bender is used. Bent pipe showing kinks, wrinkles, or other malformations will not be acceptable.

b. Steam mains. - All horizontal mains, unless otherwise indicated on the drawings, shall pitch down in direction of flow with a grade of not less than 1-inch in 40 feet. Provision shall be made at risers and at the end of each main for the proper drainage of condensate through a float and thermostatic trap. In no case shall the end of a steam main be drained through a unit heater. Any change in supply main sizes shall be made through eccentric reducing fittings. Dirt pockets shall be provided at the heels of all risers.

c. Branch connections. - All branches shall be taken from the top of the supply mains at an angle of 45 degrees above the horizontal. Branches from return mains shall be taken from the top or side; branches to unit heaters shall pitch up from the mains toward the unit with a grade of not less than 1 inch in 10 feet. All connections shall be carefully made to insure noiseless and unrestricted circulation, eliminate water pockets and air pockets, and permit the complete drainage of the system.

d. Joints. - All threaded joints shall be made with taper threads properly cut, and made perfectly tight by the use of a stiff mixture of graphite and oil, applied with a brush to the pipe thread only

and in no case to the fitting. All flanged joints shall be faced true, packed, and made up perfectly square and tight.

e. Expansion of pipe. - All pipe shall be so installed that it may contract or expand freely without damage to any other work or injury to itself.

f. Capping of pipe. - All open ends of pipe lines and equipment shall be properly capped during installation in order to keep dirt or other foreign material out of the system.

g. Pipe supports. - All horizontal runs of pipe shall be securely supported. Suspended pipe shall be supported on Clevis hangers, or equal. Chain or flat steel hangers will not be acceptable. Pipes two inches in diameter or less that are supported from side walls shall have expansion hook plates, while larger sizes shall have brackets and roller supports. All supports shall be capable of screw adjustment after erection of pipe. Hanger rods shall be fastened to concrete by means of concrete inserts. For pipes 3/4 inch to 2 inches, inclusive, hanger rods shall be 3/8-inch diameter; for 2-1/2 to 3-1/2 inches, inclusive, rods shall be 1/2-inch diameter. Pipe supports shall be spaced not more than 8 feet on centers, and at shorter intervals, where necessary, to prevent sagging.

h. Pipe sleeves. - All pipes passing through floors or walls shall be fitted with steel pipe sleeves and floor, wall, or ceiling plates. Sleeves shall be two pipe sizes larger than the passing pipe. The space between pipe and sleeve shall be properly calked with graphite packing and an approved plastic and waterproof calking compound. Floor, wall, or ceiling plates shall be of nickel-plated brass, similar and equal to Crane Company's B. & C., No. 10.

TP11-13. FLOAT AND THERMOSTATIC TRAPS. - The Contractor shall install, where indicated on the drawings or where specified, combined float and thermostatic traps designed for a steam working pressure of 15 pounds per square inch gage and an operating pressure of approximately 5 pounds per square inch gage. Traps shall be provided with a hard bronze valve seat and mechanism and brass float, all of which shall be easily removable for inspection or replacement without disturbing the piping connections. A suitable brass strainer shall be provided at the inlet to each trap. The strainer may be either an integral part of the trap or separate and installed in the pipe line on the suction side of the trap. Traps shall be installed as indicated in detail on the drawings, shall be standard catalogue products of reputable make, and shall meet the approval of the Contracting Officer.

TP11-14. UNIT HEATERS AND CONTROLS. - a. General. - The Contractor shall install, approximately where indicated on the drawings, unit heaters with propeller type fans, as indicated, having capacities not less than shown on the drawings. The unit heaters shall be rated in accordance with the Code adopted by the Industrial Unit Heater Association and the A.S.H. and V.E.

b. Support. - The heaters shall be suspended firmly from the beams or other structural members by means of approved hangers, with proper allowance for expansion and contraction and proper provision against vibration. In no case shall the steam pipes be permitted to support any part of the weight of the unit heater either during or after its installation.

c. Construction. - Each unit heater shall be of the suspended type, arranged for vertical discharge of air as indicated. The heating element and radiating fins shall be of copper. The heating element shall be free to expand or contract without developing leaks, and shall be properly pitched for drainage. It shall be tested at the factory and proved tight under a hydrostatic pressure of 200 pounds per square inch, and a certified copy of the test report shall be delivered to the Contracting Officer. The casing shall be solidly and rigidly built, and finished with lacquer or enamel.

d. Piping. - The control valve shall be the same size as the supply connection indicated, and the piping connections shall be as indicated on drawings, unless otherwise directed by the Contracting Officer. No piping shall be connected to any unit heater until the Contracting Officer is satisfied that such heater has been permanently and properly supported as specified in subparagraph b above.

e. Fan and motor. - The motor shall be fully enclosed with a metal hood, but shall be self-air-cooled in such a manner that air is drawn up through a vent pipe and circulated through the motor and expelled from the front of the motor. The unit shall be so constructed as to keep the motor under ideal operating conditions and prevent intrusion of dust, dirt, etc. The motor shall be provided with switches for both automatic and manual control, shall be equipped with thermal overload protection and shall be of suitable size and speed to operate the fan to its specified capacity. All unit heaters shall be quiet in operation at all times (see subparagraph h below),

f. Diffuser. - Each unit heater shall be provided with an adjustable type diffuser designed to distribute the air in a manner to prevent objectionable drafts.

g. Control. - (1) Thermostatic control of the heat delivered by the unit heaters shall be effected through the demand of the room thermostat upon a motorized steam valve or on the unit heater motor as indicated on the drawings.

(2) Motorized steam valves. - A motor-operated steam control valve shall be installed in the steam supply line to the unit heaters in the engine room as shown on the drawings. The valve body shall be constructed of cast iron or semi-steel. The valve shall be designed for a working pressure of 125 pounds per square inch gage, and the electric motor shall have sufficient power to operate the valve at the specified working pressure. The valve shall be equipped with

renewable seats of approved rust-resistant material. The valve shall be a standard catalogue product of reputable manufacture and shall meet the approval of the Contracting Officer.

(3) Manual switches. - The Contractor shall install, for each unit heater, in addition to the automatic controls, a manual switch with thermal overload protection for the motor as indicated on the drawings. These switches shall be similar and equal to General Electric Company's Type CR-1061-C1A, with suitable heaters.

(4) Aquastats. - An aquastat (see Paragraph TP11-16) shall be installed on each unit heater.

h. Acceptance. - (1) All unit heaters, controls, etc., shall meet the approval of the Contracting Officer. If any or all of the unit heaters are found to be objectionably noisy after the installation is completed, the Contractor shall, at the direction of the Contracting Officer, remove them and install other unit heaters which are satisfactorily quiet.

(2) If any support or piping is found to cause or permit vibration or objectionable noise, the Contractor shall make all adjustments or rearrangements necessary to correct such condition to the satisfaction of the Contracting Officer and at no additional expense to the Government.

TP11-15. RADIATORS. - a. General. - Direct cast-iron radiators shall be installed where indicated on drawings. Radiators shall be of lightweight, slenderized pattern of an approved floor type, of sizes indicated.

b. Construction. - All radiators shall be constructed of best quality gray cast iron, entirely free from sand holes or other defects. The sections shall be connected with heavy malleable-iron nipples, the thickness of which shall be not less than 0.09 inch at any point. Radiators shall be tested hydrostatically at the factory and proven tight under a pressure of 50 pounds per square inch. A certified report of these tests shall be delivered to the Contracting Officer. All radiators shall be given a shop coat of gray priming paint at the factory before shipment.

c. Radiator location and size. - The location and size of each radiator is shown on the drawings.

d. Radiator connections. - Each radiator shall be provided with top supply and bottom return connections at opposite ends, which connections shall be stubbed in under the floors on which radiators are placed. The supply connection to each radiator shall contain the radiator control valve, and the return connection shall contain the thermostatic trap. The size of the valve, trap and pipe connections to each radiator is indicated on the drawings.

e. Control valves. - Each radiator shall be equipped with a quick-opening, disc type radiator valve of the angle pattern. Valve bodies and covers shall be constructed of cast brass. The outlet side of each valve shall be provided with an all-brass, ground-ball-joint union connection. The valves shall be of the spring-retained packing type with composition mushroom handle. All valves shall be standard catalogue products of a single reputable manufacturer, and shall meet the approval of the Contracting Officer.

TP11-16. CONTROL EQUIPMENT. - a. General. - Temperature regulation in heated spaces shall be effected by the demand of room thermostats upon the unit heater or upon the motorized valve as indicated on the drawings. Unit heaters shall be equipped with aquastats wired for reverse action to prevent the operation of the unit heater motor when there is not sufficient temperature in the heating coil to guarantee against the circulation of cold air. Operation of the oil burner shall be controlled by means of a pressurestat arranged and adjusted to maintain a fairly constant steam pressure within the boiler. The pressurestat, installed on the boiler, shall operate in conjunction with a stack switch and combination boiler water feeder and low-water cut-out.

b. Room thermostats shall be of sturdy design, of a lock type, and equipped with a thermometer. They shall be designed to operate on a two-degree Fahrenheit differential, over a temperature range from 40 to 80 degrees Fahrenheit.

c. Aquastats. - An aquastat shall be installed on each unit heater and shall be wired for reverse action to standard limit controls. The electrical circuit shall be arranged to start the unit heater fan on a temperature rise and to stop it on a temperature fall. The aquastat shall be designed either for mounting on the face of the heating coil and in the direct path of the discharged air, in which case it shall be constructed with a perforated case to increase its sensitivity; or else for surface-mounting on the return pipe from the unit heater above the return-line trap, in which case it shall be calibrated for pipe temperatures rather than for air temperatures.

d. The pressurestat shall be of sturdy construction, thoroughly protected from dust and dampness, with the pressure elements in direct contact with the steam. It shall be designed to operate on a one-pound differential over a range from zero to 10 pounds per square inch gage.

e. The stack switch shall be a complete safety combustion control for intermittent ignition oil burners. It shall be designed to open the circuit after the flame has been established, to automatically recycle in case of power or flame failure or low voltage, and to automatically lock out in case of flame failure after one recycling operation. The unit shall have a simple adjustment to control ignition-timing and scavenger period.

f. The combination boiler water feeder and low-water cut-out shall be arranged to automatically feed water to the boiler when the boiler water level drops below a predetermined point and to automatically open the oil burner circuit and ring an alarm bell should the water level reach the low danger point. The boiler feeder mechanism shall be so constructed that the feed water valve and seat will be isolated from the float chamber, thereby preventing the overheating of the feed water and the consequent precipitation of scale on the valve or seat. The float, valve, and seat shall be constructed of durable corrosion-resistant alloy and the valve seat shall be renewable and removable. The device shall be equipped with a large self-cleaning strainer and a straight-through type drain valve. The low water cut-out shall be as approved by the Underwriters' Laboratories, Inc.

TP11-17. WATER HEATER AND TANK. - a. Water heater. - The Contractor shall install an indirect water heater similar and equal to Crane No. 144, or Bell and Gosset No. 144. The heater shall be capable of delivering 120 gallons of hot water in 1 hour, heating water from 50 to 150 degrees Fahrenheit. The heater coils shall consist of 1-inch O.D. copper tubes capable of withstanding a test pressure of 1200 pounds per square inch.

b. Tank. - (1) The hot water storage tank shall be galvanized welded steel, 144-gallon capacity supported on brackets, consisting of structural steel angles, as shown on the drawings. The tank shall be designed for 127 pounds per square inch water working pressure with Insurance Inspection and National Board Stamping under A.S.M.E. code requirements. The tank shall be factory tested under hydrostatic pressure of 300 pounds per square inch. The name of the manufacturer and the working pressure shall be marked on a brass plate secured to the tank.

(2) The tank shall have not less than the following tappings: hot and cold water, each 1 inch; blowoff, 1-1/2 inch; relief valve, 1 inch; thermometer, 3/4 inch.

(a) Temperature and pressure relief valve. - The tank shall be equipped with a relief valve, which shall operate automatically to relieve excess water temperature or pressure. The valve shall be automatic in its reseating action after operation due to either excess temperature or excess pressure, and shall be so designed that it will maintain its original calibration, be readily cleanable without upsetting the temperature or pressure adjustment, and have operating parts which can be readily removed and replaced. The valve shall be factory-set to relieve at a temperature of 200 degrees Fahrenheit or a pressure of 100 pounds per square inch.

(b) Thermometer. - The tank shall be equipped with a 9-inch, non-corrodible metal scale thermometer, with cast-brass frame and glass face. The thermometer shall be graduated from 30 to 240 degrees Fahrenheit. The thermometer shall be provided with an extension neck for 2-1/2-inch thickness of insulation, separable socket, and with red reflecting mercury tubing. The shank may be either the angle or straight type, as may be required.

c, Regulating valve. - The 1-inch steam regulating valve shall be installed in the steam connection to the water heater, and shall be properly adjusted after circulation. The valve shall be a direct-acting, double-seated, iron body with union ends, having a thermal element consisting of approved metallic bellows connected by armored tubing to a 10-inch copper bulb. The valve shall regulate within 2 degrees of the temperature for which it is adjusted. The range of adjustment shall be 20 degrees above or below. The operating temperature shall be 140 degrees Fahrenheit. The valve shall be similar and equal to the type manufactured by Consolidated Ashcroft Hancock Company, Fulton Sylphon Company, or Powers Regulator Company.

TP11-18. VALVES. - a. Gate and globe valves. - Gate valves shall be used throughout unless otherwise shown on the drawings. Gate valves shall be of brass or bronze of the solid-wedge, rising-stem type. Gate valves larger than 2 inches shall be outside screw and yoke type. Globe valves shall be of brass or bronze with elastic discs and rising stems. The working pressure and manufacturer's name shall be stamped or cast on each valve body. All stuffing boxes shall have packing glands. All valves shall be installed with their stems or spindles above the horizontal.

b. Check valves. - Horizontal swing check valves shall be installed where shown on the drawings or where specified. Check valves shall be of the same manufacture as the gate and globe valves.

TP11-19. STRAINERS. - The Contractor shall install, where indicated on the drawings or where specified, basket or "Y" type strainers of the same size as the pipe lines in which they are installed. Strainers shall have arrows clearly cast on the sides to indicate the direction of flow, shall be constructed of brass or bronze, and shall be equipped with an easily removable cover and sediment basket. The strainer shall have a net free area through the basket of at least four times that of the entering pipe.

TP11-20. INSULATION. - a. Boiler covering. - The boiler and breeching shall be covered with 85 percent magnesia or rock wool cement at least 1-1/2 inches thick, secured in place on 1-1/2-inch wire netting. The netting shall be held away from the boilers by metal spacers fastened to the wire. The finish coat shall contain a small amount of Portland cement, and shall be troweled to a hard, smooth surface. Cleanout and access doors shall not be insulated, but the insulation shall be neatly beveled off at the edges of such openings.

b. Pipe covering. - All heating system supply and return piping and hot water storage tank shall be insulated with standard thickness sectional pipe covering of 85 per cent magnesia with canvas finish. Pipe covering shall be held in place with 3/4 inch wide brass straps spaced to hold the ends and center of each section. In no case shall the spacing exceed 18 inches. Valves and fittings, except unions, shall be covered with 85 per cent magnesia plaster of the same thickness as the pipe covering. All plastic insulation shall be covered with cotton sheeting neatly pasted on.

TP11-21. TEMPORARY HEAT. - If temporary heat is required, the Contracting Officer will give the Contractor reasonable notice before temporary heat

will be required. The Contractor will be required to have the piping, radiators, etc., installed and ready for operation at the stated time. During the period of temporary heat the condensation shall be wasted. After the temporary heat period, the Contractor shall thoroughly clean all valves, traps, strainers, drip points, etc. Fuel for temporary heat shall be furnished by the Contractor.

TP11-22. TESTS. - a. Hydrostatic tests. - Before the boiler insulation or pipe covering is installed, the heating system shall be tested hydrostatically, at a time directed by the Contracting Officer, and proven tight under a gage pressure of 40 pounds per square inch.

b. Operating test. - Before the installation is accepted, the Contractor shall conduct a regular working test on the entire heating system at a time directed by the Contracting Officer. The operating test shall cover a period of not less than six hours. The Contractor shall furnish all necessary labor, instruments, fuel, water and electricity for conducting the test. The test shall show a free and equal circulation of steam to and condensate from each heating surface with all mechanical and electrical equipment functioning in accordance with the specifications and that the system is balanced for even heat distribution to the complete satisfaction of the Contracting Officer.

TP11-23. CLEANING AND ADJUSTING. - At the completion of all work and tests, all parts of the installation shall be thoroughly cleaned. The accumulation of oil and grease in the boiler shall be removed by blowing it off, through suitable surface blow-off connections, while under steam pressure. This process shall be repeated a sufficient number of times to effect the result so the boiler will generate steam properly and continuously, and will maintain a reasonably steady water line. As a final operation, the Contractor shall bring the pressure to about 10 pounds, draw the fire, and drain the boiler completely. After the boiler has cooled, it shall be flushed out several times and refilled to the proper operating level. The use of soda, or any alkali, vinegar or any acid will not be permitted. All equipment, pipe, valves, strainers, and fittings shall be cleaned of grease, metal cuttings, etc., and sludge which may have accumulated during testing.

TP11-24. VENTILATING EQUIPMENT. - a. Engine-room ventilation. - The engine room shall be ventilated by a ventilating fan located in the roof space as shown on the drawings. The blower shall be a direct-connected centrifugal type with backward curved blades, similar and equal to ILG Type BC 35, driven by a single-speed, 110-volt, single-phase, 60-cycle, 1140 R.P.M. motor. The fan shall have a capacity of 3400 cubic feet of standard air per minute at 1/4-inch static pressure. The motor shall have a controller and a thermal overload starting switch located on the engine room wall 4 feet 6 inches above the floor.

b. Pump room ventilation. - The pump room shall be ventilated by a blower located in the pump room with an air intake and connecting ducts as shown on the drawings. The blower shall be similar and equal to an ILG B 25 blower, direct-connected to a 110-volt, single-phase, 60-cycle, 855 R.P.M. motor. The blower shall have a capacity of 2135 C.F.M.

at 1/4-inch static pressure. The motor shall have a controller and a thermal overload starting switch located on the engine room wall, 4 feet 6 inches above the floor. Duct work shall be constructed of 20-gage galvanized wrought iron properly reinforced and supported and arranged as shown on the drawings.

c. Screening chamber ventilation. - The screening chamber shall be ventilated by a blower located as shown on the drawings with an air intake through an exterior wall and a discharge duct as indicated on the drawings. The blower shall be ILG No. B 21, or equal, direct-connected to a 110-volt, single-phase, explosion-proof, 60-cycle, 855 R.P.M. motor. The blower shall have a capacity of 1380 C.F.M. at 1/4-inch static pressure. The motor shall have a controller and a thermal overload starting switch located on the wall adjacent to the blower 4 feet 6 inches above the floor. Ductwork shall be of 16-gage galvanized wrought iron properly reinforced and supported and arranged as shown on the drawings.

d. Toilet rooms. - (1) The toilet rooms on the first floor shall be ventilated by a blower located as shown on the drawings. The fan shall be of the centrifugal type, ILG, B-18, or equal, having a capacity of 1140 cubic feet per minute at 3/8-inch static pressure when operated at 1140 R.P.M. The fan shall be driven by a 110-volt, single-phase, 60-cycle, 1140-R.P.M. motor. The fan wheel shall be carefully balanced statically and dynamically to eliminate the possibility of vibration and noise. Fan housing shall be of heavy gage sheet steel and correctly designed and formed for maximum efficiency and quietness. The motor base shall be sturdily constructed of welded steel, drilled to receive foundation bolts. The fan shall be mounted on a foundation designed for quiet operation using an insulation of cork, rubber, or felt to accomplish this result. The Contractor shall submit shop drawings of this assembly prior to proceeding with the work.

(2) The fan shall be connected to the shutters in the cupola by means of sheet metal ducts from the toilet rooms with canvas connections between the metal ducts and the fan openings. Ducts from toilet rooms shall be fitted with a vent opening from each space ventilated, as indicated on the drawings. All ductwork shall be made of 20-gage, galvanized wrought-iron sheets. The ductwork shall be brought together to one duct at the intake of the fan. Each vent opening shall be fitted with registers of the size indicated on the drawings. Each register shall have cast-brass lattice grilles.

e. Vent registers. - The Contractor shall install stock cast-brass registers with adjustable louver dampers and operating movement complete where shown and of sizes indicated. The 4-inch by 4-inch net opening grilles shall be installed at each water closet and one for the group of urinals. Grilles shall be mounted in angle iron frames, mitered and welded, drilled and tapped.

TP11-25. PAINTING. - All pipe and fittings to be covered or concealed shall be thoroughly cleaned and given one heavy coat of best quality asphaltum varnish. All pipe insulation shall be sized and painted with two coats of paint as selected by the Contracting Officer. All pipe hangers, supports, and other exposed iron work shall be given two coats of approved enamel, over the prime coat, as selected by the Contracting Officer. All painting shall conform to applicable provisions of Section XVIII of these specifications.

TP11-26. ELECTRICAL WORK. - All the automatic control, switching, starting, and protective devices, required for the operation of equipment specified in this section of the specifications shall be installed by the Contractor (see Paragraph TP11-1 b).

TP11-27. OPTIONAL EQUIPMENT. - Heating and ventilating equipment differing from that specified may be submitted, provided the Contractor clearly states such differences and all requirements and guarantees incorporated in these specifications are clearly adhered to. If the equipment offered is, in the opinion of the Contracting Officer, equal to or better than that specified, same will be given consideration for installation. When no statement of such departures is made, it will be understood that equipment in strict accordance with the specification is being furnished.

TP11-28. GUARANTEE. - a. The Contractor shall furnish a written statement guaranteeing all materials and equipment furnished and installed by him to be free from defects and capable of performing at manufacturer's maximum established rating.

b. The Contractor shall replace any part, or parts, or equipment as a whole, furnished and installed by him, found to be defective or incapable of performing at maximum established rating, within the period of guarantee, without any additional expense to the Government.

c. The period of guarantee shall extend for one year from the date of acceptance of the work.

TP11-29. PAYMENT. - a. Payment for furnishing, installing and placing the steam heating, water heating and ventilating systems, complete, as specified herein will be made at the contract price for Item 34, "Heating and Ventilating". The contract price shall include payment for control devices, wiring, and all necessary accessories.

b. Payment will not be made until tests are completed to the satisfaction of the Contracting Officer in accordance with Paragraph TP11-22.

c. The cost of all testing shall be borne by the Contractor and shall be included in the contract price for Item 34.

PART IV

SECTION XII. ELECTRIC LIGHT AND POWER SYSTEM (Item 35)

TP12-1. WORK INCLUDED. - a. The Contractor shall install complete and ready for operation, all materials, equipment and wiring for the electric light and power system of the pumping station as indicated on the drawings and as required by these specifications. The Contractor shall install the incoming service switch as shown on the drawings and shall make all necessary connections to the switchboard, gasoline-driven electric generating unit, hoist motors, and mechanically cleaned bar screen motors.

b. Within 60 days after the date of receipt by him of notice to proceed, the Contractor shall submit to the Contracting Officer, for approval and for the purpose of making dimensioned conduit layouts, detailed dimensioned drawings and data descriptive of all equipment powered by an electric motor, switchboard and all its equipment, controls, lighting distribution panelboards, floodlight, lighting fixtures, conduits, wire and accessories which he proposes to install. After all the detailed dimensioned drawings and descriptive data are approved, the Contracting Officer will prepare dimensioned conduit layouts of floor slabs only, for the Contractor's use. Floor slabs with embedded conduits shall not be placed until the Contractor has received a final conduit layout from the Contracting Officer. The Contractor will be held responsible for any delay in the placing of the floor slabs with embedded conduits, should he fail to submit equipment data within the time specified above.

TP12-2. GENERAL DESCRIPTION. - a. The complete power system includes conduit, wire, incoming service conduit, control equipment, switchboard complete, generator circuits, motor circuits and the grounding system.

b. The lighting system includes the lighting panelboards, lighting fixtures, floodlight, switches, receptacles, lamps, conduits and wire for the lighting system.

c. The battery-charging system includes conduit and wiring from the switchboard to engine batteries.

d. The pumping station will be normally supplied with electrical power at 208/120 volts, 3-phase, 4-wire, 60 cycles, A.C., directly from the utility company's underground system on Wells Street. The Contractor shall install the incoming feeder service conduit as shown on the drawings. The incoming service feeder from Wells Street to the incoming service switch will be installed by others and will not be part of this contract. A standby gasoline-engine-driven generator will supply power to the pumping station in case of an interruption of the normal source of power supply.

TP12-3. STANDARD RULES AND SPECIFICATIONS. - a. Unless otherwise specified, all electrical equipment and materials, workmanship and tests shall conform with the current standard rules, regulations and specifications of the following authorities:

(1) American Institute of Electrical Engineers, 33 West 39th Street, New York, N. Y.

(2) National Board of Fire Underwriters, National Electrical Code, 85 John Street, New York, N. Y.

(3) National Electrical Manufacturers Association, 155 East 44th Street, New York, N. Y.

(4) Insulated Power Cable Engineers Association, 420 Lexington Avenue, New York, N. Y.

(5) Federal Specifications cited herein, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

b. Copies of these rules, regulations and specifications may be procured at the addresses as given, or may be seen at the Corps of Engineers Office, Boston, Massachusetts.

c. The metering equipment shall conform strictly to the rules and regulations of the Hartford Electric Light Company, Hartford, Connecticut. It shall be the Contractor's responsibility to make arrangements with this utility company, determine their requirements, and make the installation accordingly.

TP12-4. CONDUITS. - a. Conduits shall be located approximately as indicated on the drawings.

b. The conduits shall be hot-dip galvanized or sherardized on both inside and outside, and shall meet the requirements of Federal Specification WW-C-581a for "Conduit; steel, rigid, zinc-coated". Conduit fittings or bodies shall be galvanized, sherardized or cadmium plated high-test gray iron castings or malleable iron, of the types and sizes specified, shown on the drawings, or required. All material shall be approved by the National Board of Fire Underwriters and conduit fittings shall be similar and equal in all respects to those manufactured by the Crouse-Hinds Company. Conduit sizes shall meet the requirements of Article 346 of the 1947 edition of the National Electrical Code except as otherwise noted on the drawings or herein specified and with the exception that no conduits smaller than 3/4 inch shall be used.

c. The installation of conduits shall comply with Article 346 of the 1947 edition of the National Electrical Code. All wires and cables shall be run in rigid conduits forming a complete raceway from the cabinet or panel to the last outlet in the system. Conduits shall

be run concealed, or exposed as indicated on the drawings. Conduits in masonry walls and floors shall be built in complete with all necessary fittings at the time the masonry is being placed. All exposed conduits shall be securely fastened and anchored to the structural portions of the building and shall be run parallel with or at right angles to the walls. All conduits shall be run with long-radius bends where possible, and not more than the equivalent of four 90-degree bands shall be used on any run. If more than four bends are required, pull boxes shall be installed at points approved by the Contracting Officer. As soon as possible after the concrete has set, each conduit shall be cleaned, inspected, and tested by the Contractor to ascertain its mechanical and electrical continuity and freedom from obstructions. Any defects in material or workmanship shall be remedied immediately as directed by the Contracting Officer. Conduit ends shall be capped with pipe caps. All exposed conduit, switches, boxes, etc., shall be painted as directed by the Contracting Officer (see Paragraph TP18-6).

d. Cast-iron pull boxes of the sizes specified shall be installed where indicated on the drawings. Pull boxes shall be flush type with covers held in place with brass screws. Pull boxes shall be similar and equal to the product of Thomas and Betts Company.

TP12-5. WIRING. - a. The wiring installation shall include all wire and cable, terminals, junction boxes, supports and hangers, and all connections to the equipment. All wiring shall be in rigid, threaded conduit unless otherwise specified or shown on the drawings.

b. All wire used shall be copper, soft drawn and annealed, and shall have not less than 95 per cent conductivity. Wire sizes shall comply with Article 300 of the 1947 edition of the National Electrical Code, except that no wire shall be used that is smaller than No. 12 AWG. All wire and cable used for power circuits shall be type RHL and shall conform to Federal Specification J-C-103 for "Cable and Wire; Rubber-Insulated, Building Type (0-5000-Volt Service)". All circuits shall be considered as power circuits, except branch circuits from the lighting panelboards and battery circuits. All wire and cable used for these branch circuits, except as otherwise shown on the drawings and herein specified, shall be type RW and shall conform to Federal Specification J-C-103.

c. All wire and cable shall be shipped on reels or in coils, plainly marked for complete identification, including the wire or cable size, number of conductors, length, weight, thickness, character of the insulation and the name of the manufacturer.

d. Materials used in the wiring shall conform to the following requirements:

(1) Solder for splicing or wiping shall conform to Federal Specification QQ-S-571a, for "Solder; Tin Lead," Grade A for sweat conductor joints.

(2) Solder for brazing shall conform to Federal Specification QQ-S-551, for "Solder; Brazing," Composition B.

(3) Silver solder shall conform to Federal Specification QQ-S-561a for "Solder; Silver," Class O.

(4) Rubber tape shall conform to Federal Specification HH-T-111b for "Tape; Rubber Insulating".

(5) Friction tape shall conform to Federal Specification HH-T-101a for "Tape; Friction," Grade A.

(6) Cotton tape shall conform to United States Navy Department Specification 17-T-15 for "Tape; Insulating, Linen Finish, plain", thickness .007 inch.

e. The following wire and conduit schedule shall be used for this station:

Circuit	From	To	Number of Conductors	Conductor Type & Size	Conduit Size
Incoming	Service Switch	Swbd	1-4/c	No. 1/0 R.H.L.	3"
Generator	Generator	"	1-4/c	No. 4 R.H.L.	2"
Exciter	Generator	"	1-4/c	No. 12 R.H.L.	1"
Hoist No. 1	Hoist No. 1	"	1-3/c	No. 12 R.H.L.	1"
Hoist No. 2	Hoist No. 2	"	1-3/c	No. 12 R.H.L.	1"
Hoist No. 3	Hoist No. 3	"	1-3/c	No. 12 R.H.L.	1"
Hoist No. 4	Hoist No. 4	"	1-3/c	No. 12 R.H.L.	1"
Bar Screens	Bar Screen Motors	"	1-2/c	No. 12 R.H.L.	1"
Charger	Batteries	"	6-1/c	No. 12 R.W.	3/4"
Lighting	Office Panelboard	"	1-3/c	No. 8 R.H.L.	1-1/4"
Lighting	Storeroom Panelboard	"	1-3/c	No. 10 R.H.L.	1-1/4"
Lighting	Basement Hall Panelboard	"	1-3/c	No. 10 R.H.L.	1-1/4"
Rubbish Hoist	Rubbish Hoist	"	1-2/c	No. 12 R.H.L.	3/4"
Sump Pump	Sump Pump	"	1-2/c	No. 12 R.H.L.	3/4"
Branch Lighting	-		1/c as required	No. 12 R.W.	3/4"
Heating & Ventilating	-		1/c as required	No. 12 R.W.	3/4"
Ground	Generator	"	1-1/c	No. 4 bare, strd.	3/4"
Ground	Water Pipe	"	1-1/c	No. 4 bare, strd.	3/4"

f. The ends of the lead-covered cables shall be sealed by building up an insulated cone with rubber and friction tape at the end of the cable and covering the cone with insulating varnish.

TP12-6. GROUNDING. - The neutral of the power supply, switchboard, generator, all metal cabinets enclosing electrical equipment and all conduits shall be effectively bonded and grounded to comply with the National Electrical Code and as herein specified. All conduit at the switchboard shall be bonded together with a No. 6 copper cable using standard grounding bushings for this purpose. The switchboard frame and neutral of the power supply shall be grounded to this conduit ground system. A separate ground shall be installed in the ground conduit between the switchboard and the generator and from the switchboard to the cold water service. Conduits entering cabinets, switches, controllers, etc. shall be provided with standard grounding bushings which shall be used to effectively ground the conduit to the metal enclosures. The use of locknuts and bushings will not be acceptable as a means of grounding conduit to enclosures. The switchboard neutral bus shall be grounded at one point only.

TP12-7. LIGHTING AND OUTLETS. - a. The lighting panelboards, plug receptacles, tumbler switches, lamps, outlet boxes and pull boxes shall be installed as specified and at locations indicated on the drawings and shall be in accordance with the description as shown on the Bill-of-Material.

b. Lamps, including those for the floodlight shall be rated at 115 volts and of the watt rating shown or specified and shall conform to Federal Specification W-L-101e for "Lamps; Electric, Incandescent, Large, Tungsten Filament".

c. All lighting fixtures shall be similar and equal to those specified herein and shown in the Bill-of-Material.

d. One floodlight shall be installed on the northeast wall of the pumping station, above the bar screen as shown on the drawing. The floodlight shall be similar and equal to Benjamin Catalogue No. 56022M complete with 500-watt, 115-volt, mogul base, general service, clear glass lamp, type M, crossarm mounting bracket and stippled glass cover.

e. The lighting fixtures in the engine room shall be two types: RLM dome reflectors, similar and equal to Benjamin "Turnlox" catalogue No. 9425, installed along the roof gable above the catwalks; and RLM reflectors, similar and equal to Benjamin "Turnlox" elliptical angle reflectors catalogue No. 3526R, installed along the engine-room walls. The lighting fixtures in the pump room shall be similar and equal to Benjamin catalogue No. 5643.

f. Lighting fixtures for the office, toilets, storeroom, all exterior building lights and post lights will be furnished by the Government and shall be installed by the Contractor.

TP12-8. PANELBOARDS. - a. Three lighting panelboards shall be installed, one in the office, one in the basement hall and one in the

storeroom. All lighting panelboards shall be arranged for 3-phase, 4-wire service with lugs in the mains.

b. The panelboard in the office shall have twelve single-pole, 15-ampere, 250-volt automatic circuit breakers and shall be similar and equal to flush-mounted Westinghouse Electric Corporation's Catalogue No. [illegible]B12-4L. The width of this panelboard including trim shall not exceed 20 inches.

c. The panelboard in the basement hall shall have six single-pole, 15-ampere, 250-volt automatic circuit breakers and shall be similar and equal to flush-mounted Westinghouse Electric Corporation's catalogue No. NA1B06-4L.

d. The panelboard in the storeroom shall have eight single-pole, 15-ampere, 250-volt automatic circuit breakers and shall be similar and equal to flush-mounted Westinghouse Electric Corporation's catalogue No. NA1B08-4L.

e. A suitable name plate shall be placed at each switch of all panelboards to indicate the circuit controlled by it. Name plates shall be black bakelite with white engraved letters. A list of all proposed name plates shall be submitted to the Contracting Officer for approval. The panelboards shall have side gutters of uniform width on four sides and ample dimensions to accommodate branch circuits and incoming feeders. Interior trim shall be provided.

TP12-9. MISCELLANEOUS MATERIAL AND CONSTRUCTION. - a. The Contractor shall install where indicated on the drawings in the engine room and office 12-inch diameter, round, metal, surface-mounted self-starting electric clocks with black arabic numerals, white dial and black spaded hands. The clocks shall be similar and equal to Telechron No. 445 suitable for operation on 110-115 volts, 60 cycles, A. C.

b. The Contractor shall install, in the station, a doorbell system as shown on the drawings. The system shall include conduit, boxes, wire, push button, bell, transformer, etc. All material for the bell system shall be in accordance with the description shown on the Bill-of-Material.

c. Provisions for telephone service shall be as shown on the drawings. Two 1-1/2-inch steel conduits shall be run from the telephone boxes in the engine room to a point two feet outside the building and two feet below grade. These conduits shall be capped with pipe caps.

TP12-10. SWITCHBOARD. - a. The Contractor shall install in the engine room at the location shown on the drawings a three-panel, free-standing, safety, steel-enclosed, dead-front type switchboard with removable cover plates at the sides and rear, 78 inches high by 78 inches wide by 48 inches deep (approximate dimensions), (see Paragraph TP12-11 a, b, and c for details). This switchboard shall provide electric power control for the entire pumping station.

b. Facing the switchboard from the front, the panels left to right shall control the circuits listed:

(1) Panel No. 1.

Top Section.

Combined generator, exciter and regulator panel for gasoline-electric standby generator unit. Capacity, 31 Kva at 80 per cent power factor, 25 KW, 208/120 volts, 3-phase, 4-wire, 60 cycles, A.C. with 125-volt, D. C. direct-connected exciter.

Middle Section

Incoming feeder from the outside power source.

Bottom Section

Incoming feeder from the standby generator unit.

(2) Panel No. 2

Top Section

One feeder, 120 volts, single-phase, 60 cycles, A. C. for the battery charger input.

One feeder made up of 5 circuits to the various storage batteries.

Middle Section

Four feeders, 208 volts, 3-phase, 60 cycles, A. C. to the gate hoist motors.

Two feeders, 208 volts, single-phase, 60 cycles, A. C. to the mechanically cleaned bar screen motors.

Three feeders, 208/120 volts, single-phase, 3-wire, 60 cycles, A. C. to the lighting panelboards.

One feeder, 120 volts, single-phase, 60 cycles, A. C. to the rubbish hoist.

One feeder, 120 volts, single-phase, 60 cycles, A. C. to the sump pump.

Bottom Section

Blank

(3) Panel No. 3

Door with lock and concealed hinges.

c. The rear of Panel No. 3 shall not contain any equipment. Panels 1 and 2 shall contain the following equipment:

(1) Panel No. 1

One voltage regulator complete with all necessary auxiliary equipment. (Voltage regulator rheostat knob shall be located on the front of the switchboard.)

One mounting for the exciter-field rheostat. The exciter-field rheostat will be furnished under Item 36 (see Paragraph TP13-6).

One voltmeter, 0-300 volts, 60 cycles, A. C. with selector switch for reading the phase voltages of the incoming line from the commercial power source and from the generator complete with the necessary fuse blocks and fuses.

One wattmeter, 0-35 KW.

One ammeter, 0-75 amperes, 60 cycles, A. C. with three current transformers, 75 to 5 amperes and a selector switch for reading the three phase currents.

One ammeter, 0-10 amperes, D. C. for reading the generator field current.

One frequency meter, 60-cycles.

Complete potential and current test blocks mounted on the front of the board.

Two 70-ampere, 600-volt, 3-pole, air circuit breakers with an interrupting capacity of 15,000 amperes for the 31-Kva standby generator and commercial power source, each provided with inverse time-delay magnetic over-current trips. Undervoltage devices shall not be used on these breakers. The breakers shall be mechanically interlocked.

Two pilot lights, one to indicate commercial power "ON" and one to indicate standby power "ON". (Locate on same panel as controlling breaker.)

(2) Panel No. 2

Five ammeters, 0-15 amperes, D. C. for indicating the D.C. input to each battery.

Five rheostats for varying the input current of each of the five storage batteries. These switches shall have an "OFF" position.

One voltmeter, 0-20 volts, D.C. for indicating the voltage of each battery separately.

One voltmeter switch, six-point, for switching the battery circuits to the voltmeter. One point shall be the "OFF" position.

One 15-ampere, 250-volt, single-pole, air circuit breaker provided with a suitable thermal overload and instantaneous short-circuit trip for the incoming circuit to the battery charger.

One 25-ampere, 250-volt, double-pole, air circuit breaker provided with suitable thermal overload and instantaneous short circuit trips for the outgoing circuit from the battery charger.

Five 35-ampere, 600-volt, three-pole, air circuit breakers, provided with suitable thermal overload and instantaneous short-circuit trips for the circuits to the sluice gate motors and one spare.

One 35-ampere, 600-volt, three-pole, air circuit breaker provided with thermal overload and instantaneous short-circuit trips for the circuit to the office panelboard.

Two 25-ampere, 600-volt, three-pole air circuit breakers provided with thermal overload and instantaneous short-circuit trips for the circuits to the storeroom and basement hall panelboards.

Two 15-ampere, 600-volt, double-pole, air circuit breakers provided with thermal overload and instantaneous short-circuit trips for the circuits to the two mechanically cleaned bar screen motors.

One 25-ampere, 250-volt, single-pole, air circuit breaker provided with thermal overload and instantaneous short-circuit trips for the circuit to the rubbish hoist.

One 25-ampere, 250-volt, single-pole, air circuit breaker provided with thermal overload and instantaneous short-circuit trips for the circuit to the sump pump.

The switches on Panel No. 2, so far as possible, shall be arranged as follows:

Top Section

All instruments and adjustment dials and incoming and outgoing breakers for the battery circuit.

Middle Section

The twelve breakers shall be arranged in three rows. The first row shall contain 4 breakers for the gate hoist motors. The second

row shall contain 3 breakers for the panelboard circuits and one spare. The third row shall contain 2 breakers for the mechanically cleaned bar screen circuits, one breaker for the sump pump circuit, and one breaker for the rubbish hoist.

Bottom Section

Blank

(3) Panel No. 3

No equipment.

TP12-11. CONSTRUCTION OF SWITCHBOARD. - a. Panels. - The switchboard shall be of the dead-front totally enclosed type of construction conforming to standards of the NEMA. All panels shall be of 1/8-inch, stretcher-leveled steel, with a 1/4-inch radius bevel on all front edges, and of equal width. Panels shall have rolled edges. The width of the panels shall be such as to give a compact and neat arrangement of the equipment without sacrificing efficiency and accessibility in the operation and maintenance of the switchboard. All panels shall be bolted to the switchboard frame and Panels No. 1 and No. 2 shall be subdivided into vertical sections which may be removed to give access to apparatus on the subpanel. Panel No. 3 shall be a door. The top section of Panel No. 1 shall be a hinged door type with all instruments, test blocks, etc., attached to the door. In Panel No. 2, slots with suitable trim shall be provided to accommodate the handles of all switches and breakers. There shall be provided on the front of the panel a visual indicator of the mechanical type to show the position of each switch or breaker. No gaps or wide joints shall be visible in the completed assembly. Three lifting eyebolts shall be installed in the top of the switchboard.

b. Rear cover plates. - The rear of Panel No. 1 and No. 2 of the switchboard shall be enclosed by framed cover plates with a 1/4-inch radius bevel on outside edges, which shall run the full height of the switchboard. The cover plates shall fit snugly and no gaps or wide joints shall be visible in the completed assembly. No rear cover plate is required for Panel No. 3

c. Side cover plates. - Facing the front of the switchboard, the left-hand end enclosure shall be enclosed by framed cover plates with a 1/4-inch radius bevel on outside edges, which shall run the full height of the switchboard and shall be in one piece. The right-hand end enclosure shall be between Panel No. 2 and Panel No. 3. This end enclosure shall have a swinging door with lock and concealed hinges. The door shall be not more than two feet wide starting at the rear edge of the switchboard between Panels No. 2 and No. 3 with the hinged side towards the rear of the board.

d. Busses and wiring. - All power conductors shall be of the proper cross section for the currents to be carried and no power wire

shall be smaller than No. 8 A.W.G. All control wire on the panels shall be installed in wiring gutters provided on the side of the panels and shall be brought out to terminal blocks where the wires leave the panels. Leads to instruments on the door section of Panel No. 1 shall be extra flexible type. All busses shall be mechanically rigid and designed to carry the rated current to the circuit with a maximum temperature rise of 30 degrees Centigrade. Copper soldering lugs shall be provided for all breakers and outgoing and incoming circuits.

e. Fuses. - All fuses for instrument circuits and control circuits shall be located at an easily accessible location.

f. Finish. - All steel work shall be bonderized or given similar approved treatment, and also given a dull black marine finish.

g. Name plates. - Suitable name plates shall be attached to the switchboard for all circuits, controls and instruments. Name plates shall be bakelite with white engraved letters. A list of all proposed name plates shall be submitted to the Contracting Officer for approval.

h. Insulating mat. - A rubber insulating mat shall be furnished and placed in front of the switchboard. It shall extend the full length of the switchboard, and shall be 3/8 inch thick by 36 inches in width.

TP12-12. SWITCHBOARD EQUIPMENT. - a. Air circuit breakers for the feeders from the standby generator and the outside power course shall be 3-pole, single-throw, stationary-mounting, trip-free, manually-operated, rated at 600 volts, 60 cycles, A. C. and have an interrupting capacity of 15,000 amperes. The air circuit breakers for the generator feeder and for the feeder of the outside power source shall be provided with three inverse time-delay magnetic overcurrent trips and a mechanical interlock attachment on each circuit breaker. The mechanical interlock attachments shall be interconnected by a shaft acting directly on the pole-shaft so that only one circuit breaker can be in a closed position at any time. A suitable switchboard trim shall be provided for these breakers.

b. Air circuit breakers for feeder protection of motors and equipment feeding from the main bus shall be provided with suitable thermal-overload and instantaneous short-circuit trips and shall be rated at 600 volts, 60 cycles, A. C. and shall have an interrupting capacity of 10,000 amperes. The circuit breakers for the input and output side of the battery charger and switchboard heater units shall be provided with suitable thermal-overload and instantaneous short-circuit trips and shall be rated at 250 volts. Breakers shall have as many over-load trips as there are poles.

c. Instruments shall be rectangular, semi-flush-mounted, with a 5-inch scale, and shall be similar and equal to the product of the

Westinghouse Electric Corporation. The wattmeter shall be the 3-element type to accurately read the power in the circuits. All instruments shall be complete with necessary auxiliary resistors, transformers, etc.

d. Instrument switches for reading line voltages and currents shall be the rotary type, similar and equal to the product of the Westinghouse Electric Corporation. The voltmeter switches shall be connected to read the 3-phase voltages on both commercial and standby power.

e. The voltage regulator shall be designed for automatic voltage control of the generator and arranged for operation in the exciter shunt-field circuit. The regulator shall provide good regulation up to 150 per cent of rated generator capacity and shall be similar and equal to Westinghouse Electric Corporation, Type SRA-1.

f. A battery charger of the copper-oxide type shall be installed inside the switchboard. The output side shall be connected to the battery-charging system specified in Paragraph TP12-2 c and the input side shall be capable of operating at 120 volts, 60 cycles, A.C. The charger shall have a sufficient capacity to charge two 12-volt batteries in parallel at a charging rate of 12 amperes each with positive terminal grounded. The charger shall be provided with a separate adjustment in the circuit to each battery for varying the charging rate from zero to maximum in at least 6 steps and a separate miniature rectangular ammeter to indicate the direct current output to each battery. The adjustment shall be operated from the front of the switchboard. A miniature rectangular voltmeter and voltmeter switch shall also be provided to read the voltage across each battery. This switch shall have an "OFF" position. The instruments shall be flush-mounted on the front of the switchboard.

g. All fuses shall be readily accessible and shall comply with Federal Specification W-F-79la for "Fuses; Cartridge, Inclosed, Non-Renewable".

TP12-13. TESTS AND GUARANTY. - a. Tests required to indicate and insure the proper and desired operation of all electrical equipment, control and wiring, shall be made in the presence of the Contracting Officer or his representative. The switchboard will be inspected at the place of manufacture and shall be approved by the Contracting Officer or his representative prior to shipment. Each circuit shall have an insulation resistance between the conductors and between conductors and ground of not less than ten megohms. After all electrical material and equipment is in place and connected, the Contractor shall make a load study test of the station on both commercial and standby power and submit results of such tests in writing to the Contracting Officer. This report shall include tests on each motor individually and on the complete station under maximum possible load conditions.

b. The Contractor shall guarantee all material and equipment for a period of one year from the date of final acceptance. Any defects disclosed within that period due to faulty material and equipment, furnished by the Contractor, shall be repaired or replaced promptly by the Contractor at no additional expense to the Government. All meters used for testing shall be furnished by the Contractor.

TP12-14. PAYMENT. - Payment will be made at the contract price for Item 35, "Electric Light and Power System", and shall include all costs for furnishing, installing, testing, placing the complete light and power system in operation as shown on the drawings and as required by these specifications. Payment will be made after the material and equipment have been furnished, installed, tested and placed in operation to the satisfaction of the Contracting Officer.

PART IV

SECTION XIII. GASOLINE-ELECTRIC STANDBY UNIT (Item 36)

TP13-1. WORK INCLUDED. - The Contractor shall design and install one complete and fully equipped gasoline-electric standby unit in the location shown on the drawings.

TP13-2. GENERAL DESCRIPTION. - a. The unit shall consist of a gasoline engine directly connected through a flexible coupling to a revolving field, synchronous type, alternating-current generator with a direct-connected exciter. The unit shall be mounted on a common cast iron or structural steel base. The generator shall be a 3-phase, 208/120-volt, 4-wire, 60-cycle, and shall have an output rating of 31 Kva at 80 per cent power factor, 25 KW. A suitable exciter field rheostat shall be furnished with the generator.

b. The unit shall be equipped with a storage battery and electric starting motor, a battery-charging generator, detachable hand crank, and all other necessary appurtenances for a complete installation.

c. Vibration. - The unit, complete with all accessories, shall be free from objectionable vibrations within the range of 120 r.p.m. below to 120 r.p.m. above normal speed.

d. Fuel. - The engine fuel used in all tests shall conform to Federal Specification VV-G-101a for "Gasoline; Motor, United States Government", and shall have an octane number of 60 to 70.

TP13-3. GASOLINE ENGINE. - a. General. - The gasoline engine for the standby unit shall be the product of a reliable manufacturer who can show at least five years of experience in the successful manufacture of engines of the type specified and for similar duty. The engine shall be of the four-cycle type with four or more cylinders and shall have a published continuous rating of not less than 60 brake horsepower at 1200 r.p.m. It shall have a published continuous speed rating of not less than 1200 r.p.m. The engine shall be ruggedly constructed for heavy duty and long life. All other details of construction not specifically mentioned shall conform with standard practice.

b. Construction details. - The principal parts of the engine shall be as follows:

(1) The crankcase shall be of the pedestal base type with large side plates easily removable for inspection and adjustment of all bearings and other parts.

(2) The cylinder block shall be separate from the crankcase, and shall be cast in one piece or in pairs of cylinders. Cylinders and heads shall be fully water-jacketed.

(3) Pistons shall be light-weight cast iron or suitable alloy, and of such construction as to provide uniform expansion of the piston skirt. Each piston shall have at least four rings, three above the piston pin and one below. Piston pins shall be made of hardened tubular steel, accurately ground and securely locked in place.

(4) The crank shaft shall be made of one piece, heat-treated alloy forging substantially designed to withstand the most severe operating conditions. It shall be dynamically and statically balanced and all journals shall be ground and polished. The crank shaft shall be drilled to provide oil feed from the pressure system to the connecting rod bearings.

(5) The camshaft shall be of high-grade, forged, heat-treated steel with integral cams.

(6) The connecting rods shall be of high-grade forged steel, properly heat-treated.

(7) Push rods shall be of hardened steel and accurately ground. Push rod guides shall be of suitable material to resist wear and heat and shall be removable.

(8) The flywheel shall be of gray iron or steel and shall be statically and dynamically balanced. It shall be constructed to withstand the maximum speed which the engine would attain with a fully open throttle at no load and shall be securely attached to the crank shaft on the engine side of the flexible coupling.

(9) The flexible coupling shall be similar and equal to Morse all steel standard coupling, and shall be provided with a suitable guard. The coupling shall be designed to transmit 300 per cent of the normal operating torque of the engine.

(10) The main bearings shall be of a readily removable sleeve type and shall be accurately fitted and anchored against side thrust. Oil, under pressure, shall be suitably admitted to the inside of each main bearing shell.

(11) The valves shall be of special heat-resisting steel, of large area, accurately fitted and ground to fit the valve seats. The valve seats shall be removable and of special steel, heat-treated.

(12) Gear-driven pump and oiling system. - A positive displacement gear-driven pump shall supply oil under pressure to the main bearings, connecting rod bearings, valve operating mechanism, piston pins, and timing gears. The pump shall be accessible and removable without dismantling the engine. An oil pressure gage shall be installed on the control board. The gage shall be operated by a connection to the end of the main oil line. A suitable, high-grade oil filter with safety by-pass valves and an oil cooler shall be provided and installed on the engine.

An oil-pressure-operated switch shall be provided. This switch shall be operated by a connection to the main oil line and arranged so that it will open the ignition circuit in the event that the oil pressure at the end of the main line is not adequate for safe operation of the engine. A foot-operated switch shall be provided for use when the engine is being started to cut out the oil pressure safety switch.

(13) One carburetor equipped with choke, air filters, flame arrester, gasoline filter, drip pan and piping shall be provided. The engine shall be equipped with an engine-driven diaphragm type gasoline pump and a hand pump suitable for pumping the gasoline from the tank to the engine. The carburetor and gasoline piping shall conform to the requirements of the Underwriters' Laboratories. Connections to gasoline lines shall be made with flexible seamless bronze hose with woven wire protection and packless connections. Air leakage around the pivot of the butterfly valve shall be eliminated to provide good mixture control.

(14) Ignition and starting system. - (a) A 12-volt battery-distributor system and an approved magneto with an impulse coupler system shall be provided. There shall be two spark plugs in each cylinder, fired simultaneously. The ignition shall be so controlled that either type of ignition may be used by operating a switch. The starter push button switch shall consist of two single-pole contacts in tandem so arranged that the battery charging circuit is opened before the engine cranking circuit is closed. The switch shall be spring-operated and shall close the battery-charging contacts in its normal position. A terminal block enclosed in an outlet box and connected with No. 12 wire to the battery shall be installed on the standby unit engine to provide for connecting the battery charging leads from the battery charger on the station switchboard.

(b) A 12-volt, heavy-duty electric cranking motor shall be provided for starting the engine. The cranking motor shall be controlled by a 12-volt magnetic switch. The cranking motor shall be capable of cranking the engine at sufficient speed to insure starting. Suitable provision shall be made to prevent operation of the engine cranking motor except when the spark control lever is in full-retard position.

(c) A 12-volt storage battery shall be provided. The battery shall have sufficient capacity to provide 3-minute continuous cranking of the complete unit under operating conditions with an ambient engine room temperature of 32 degrees Fahrenheit. The minimum capacity of the battery shall be 200 ampere hours.

The battery shall have a special plate construction for severe or unusual conditions. Each positive plate shall be composed of multiple insulation containers filled with active materials, the containers to run vertically, horizontally or diagonally, permitting free passage of electrolyte from one face of the plate to the other; each container shall be slotted or perforated to permit diffusion of the acid electrolyte into the containers.

The electrolyte shall be of the low-gravity type with a specific gravity of 1.200 to 1.220.

The battery shall conform to the specifications for United States Government award by the Treasury Department, Procurement Division, Branch of Supply, for lead-acid storage batteries, Class 17, Item B8630.

A suitable shelf or platform with an acid-proof rubber or lead tray shall be provided on or located adjacent to the engine base for mounting the battery.

(15) Governor. - The governor shall be of the mechanical flyball type capable of maintaining a constant engine speed under fluctuating load conditions. The difference in speed between full load and no load shall not be greater than 3 per cent of the rated operating speed of 1200 R.P.M. Maximum change in speed shall not exceed 5 per cent of the rated operating speed of 1200 R.P.M., when full load is applied instantaneously. Regulating devices for the governor shall be so designed that adjustments may be made easily and accurately.

(16) Overspeed switch. - The engine shall be provided with an automatic ignition cut-out switch that will shut the engine down when the engine speed exceeds that normally controlled by the governor. The cut-out switch shall be adjustable and provided with manual reset.

(17) The exhaust manifold shall be a close-grained gray iron casting, water-jacketed for its entire length, and provided with suitable flange connections having straight pipe thread for exhaust pipe. A water-cooled brass or bronze flexible exhaust shall be provided as shown on the drawings and shall be similar and equal to that manufactured by the Packless Metal Products Corporation of Long Island City, New York.

(18) Exhaust silencer for the engine shall be provided for mounting in the roof space as shown on the drawings. The silencer shall be of corrosion-resistant metal and shall be similar and equal to Model MU-2, manufactured by the Maxim Silencer Company, or the equivalent silencer manufactured by the Burgess Battery Company. The silencer shall be equipped with removable bronze drain plugs. The Contractor shall install two 1-inch thicknesses of insulation similar and equal to Keasbey & Mattison "Hy-Temp", Johns-Manville "Superex", or Carey "Hi-Temp" with an 8-ounce canvas jacket for exhaust pipe assembly insulation as shown on the drawings. Insulation shall be preformed in semi-circular 180-degree sections. Block insulation or 2-inch thick pipe insulation on piping will not be acceptable. All joints shall be staggered and sealed with high-temperature cement plaster. The canvas jacket shall be cut back 2 inches from all hot metal surfaces. Where canvas jacket is cut back the insulation shall be covered with asbestos paper extending under the canvas and to the exposed metal surfaces. The expansion joint shall be similar and equal to the internally guided expansion joint as manufactured by the American District Steam Co., North Tonawanda, N. Y.

(19) Cooling system. - The engine shall be water-cooled with water obtained from the city water system. A temperature-regulated valve shall be installed in the cooling water intake to regulate the flow of cooling water through the engine. The regulator shall be similar and equal to that manufactured by the Fulton Sylphon Company. A suitable gate valve shall be installed in the line ahead of the regulator. The Contractor shall provide temperature-operated switch so arranged that it will open the ignition circuit in the event the cooling water temperature exceeds that at which the switch is set to operate.

TP13-4. MISCELLANEOUS EQUIPMENT. - a. Instrument panel. - A polished metal panelboard shall be installed on the engine and the following instruments and equipment mounted thereon:

1 tachometer
1 main oil line pressure gage
1 ammeter
1 cranking motor push-button switch
2 ignition switches
1 water temperature gage.

b. Tools. - One set of special wrenches and tools shall be provided and mounted in a sheet steel cabinet on the wall of the pumping station.

TP13-5. GENERATOR. - a. The generator shall be of the standard, rotating field, synchronous type having the rating specified in Paragraph TP13-2. When the generator is operating continuously at full-rated load and voltage, the temperature rise in the cores and windings shall not exceed 50 degrees Centigrade above an ambient temperature of 40 degrees Centigrade. The generator shall conform to the standards of the American Institute of Electrical Engineers, and National Electrical Manufacturers Association, and the American Standards Association. It shall be a regularly manufactured type and model of a make that has been regularly manufactured for at least 5 years.

b. The stator and rotor windings shall be insulated with Class "A" insulation. The armature terminals shall be located as shown on the drawings, and shall be housed in a terminal box, with a removable cover, to which conduit may be readily connected from below.

c. The generator shall be provided with two sleeve bearings of ample size. The bearings shall be of phosphor bronze or bronze and babbitt lined, and shall be positively self-lubricated by oil rings extending into an oil reservoir.

d. Slip rings shall be of bronze or brass. Brush holders shall be of rugged construction, marine type and shall be provided with an adjustable tension spring which can be adjusted while the machine is in operation and then locked in position. All ferrous materials shall be corrosion-resisting or shall be rust-proofed by a suitable process.

TP13-6. EXCITER. - The exciter shall be mounted on an extension of the generator end bracket, and shall be direct-connected to the generator. The exciter shall be shunt-wound and of sufficient capacity to afford proper excitation to the generator field coils at 150 per cent of the generator rating. The terminal voltage shall be 125 volts d-c. A rheostat shall be furnished for the exciter field and shall be of the rotary type suitable for mounting on the back of the power switchboard with the controls extending through to the front of the switchboard.

TP13-7. DESIGN AND DRAWINGS. - a. The detailed design of the standby unit shall be such that all working parts will be readily accessible for inspection and repair, easily duplicated, and readily replaced with each and every part of the equipment of the machine properly designed and suitable for the uses and service required.

b. The Contractor shall submit drawings, specifications and characteristic curves for the proposed standby unit for approval. The drawings shall include the engine, generator, exciter, and all accessories, with dimensions of concrete base for mounting. Accessories shall be listed on the drawings by catalogue number with name of manufacturer and shall be accompanied by cuts and the manufacturer's specification for the accessories, all properly numbered to agree with the list as shown on the drawings.

TP13-8. INSTALLATION. - a. All work shall be neatly and accurately accomplished and shall be in accordance with the highest standards of practice for equipment of the type to be furnished. At the factory the engine and generator shall be accurately aligned on the bed-plate and securely attached thereto. Provision shall be made for lifting the engine and generator, each separately, and the entire unit by a crane.

b. Anchor bolts, sleeves, washers, and nuts shall be embedded in the concrete base as shown on the drawings. When setting anchor bolts, the Contractor shall first construct a rigid template made of 2" x 6" wood plank to hold the anchor bolts rigidly in place. Holes for the anchor bolts shall be bored in the template accurately and of such a diameter that the anchor bolts shall fit tightly into the holes. After the anchor bolts are assembled in the template with the sleeves, 6-inch washers and nuts below, the top nuts shall be screwed on top of the bolts and pulled down tightly against the template. The bolts and sleeves shall be cast into the concrete while being held rigidly in the template.

c. For the installation of the gasoline-electric generating set, the unit shall be set on the anchor bolts on steel shims leaving approximately 1-inch for grout. The unit shall be set level and shall be checked for level by means of a machinist's level. The flexible coupling shall then be sufficiently disassembled so that a check of the coupling alignment can be made. The Contractor shall then, by means of shims, feather-edged wedges, and anchor bolts, so adjust the base plate that the misalignment of the flexible coupling does not exceed .005 inch.

d. Parts of wedges which otherwise would extend beyond the finished grout shall be cut off and the unit shall be grouted according to the detail shown on the drawings, with a non-shrinking cement similar and equal to "Embeco" cement as manufactured by Master Builders Company of Cleveland, Ohio. After the grout has set up it shall be rubbed to a smooth finish according to the detail shown on the drawings.

TP13-9. INSPECTION AND TESTS. - a. Shop tests. - The complete engine unit, including cooling system, etc., shall be run two hours continuously at a load corresponding to 50 per cent overload of generator on dynamometer test. The combined unit shall be tested by operation at the works of the manufacturer for not less than 8 hours in the presence of an authorized representative of the Contracting Officer. Under this test, the set shall be run at rated speed, voltage and output, and at rated speed and voltage at varying loads from no load to 125 per cent overload. Any other tests requested by the Contracting Officer during the eight-hour running test shall be made at the works of the manufacturer. Under all tests there shall be no evidence of serious vibration. The valve setting and governor adjustment shall be checked with the combined unit operating under various loads in the speed range specified. Immediately after the tests, the Contracting Officer will require the engine to be opened up for inspection. A typewritten record of all shop tests, including all observations, results and graphs, shall be certified and submitted to the Contracting Officer, in triplicate, as soon as practicable after completion of the tests.

b. Final acceptance tests. - Final acceptance tests and trials of the gasoline-electric generator set shall be made by the Contractor upon completion of the installation. The combined engine-generator unit shall be run for 12 continuous hours at full rated capacity of the generator. The Contractor shall provide a temporary load of 25 kW by placing three water barrels filled with a salt solution outside the pumping station and arranging electrodes in each, connected to the main bus of the switchboard, so that a properly balanced 3-phase, 4-wire water rheostat has been constructed. If during the tests any imperfections of equipment, workmanship, or arrangement are found, proper correction shall be made and the entire test or any portion of it shall be repeated as directed by the Contracting Officer. The gasoline engine shall operate smoothly, without undue noise or vibration; the governor shall maintain an even speed at all loads and the carburetors shall function without flooding and without back-firing; the electrical equipment shall operate without any indication of excessive heating and shall maintain an even voltage at all loads. Such additional tests as necessary may be required by the Contracting Officer. The Contractor shall secure the services of a representative of the manufacturer of the unit who shall supervise the running of final acceptance tests. All final acceptance tests shall be made in the presence of an authorized representative of the Contracting Officer.

c. The Government will provide all fuel and lubricants

necessary to place the gasoline-electric generator unit in operation, and for the 12-hour full-load test. In the event the specified tests must be rerun due to failure of the unit to comply with the specifications, the Contractor shall provide the fuel for the additional tests at no additional expense to the Government.

d. After the tests are completed the Contractor shall retighten all anchor bolt nuts.

TP13-10. PAINTING. - Shop painting shall be in accordance with the applicable provisions in Section XVIII. Such retouching as may appear necessary in the opinion of the Contracting Officer shall be done with the same shade of paint as the shop coat. All finished surfaces to be exposed to the atmosphere during shipment shall be coated with a heavy rust-preventative compound. Field painting of all exterior parts, except brass, bronze or finished surfaces, shall be done in accordance with the applicable provisions in Section XVIII.

TP13-11. PAYMENT. - a. Payment for designing, furnishing, painting and installing the equipment and materials specified herein will be made at the contract price for Item 36, "Gasoline-Electric Standby Unit". Payment shall include all costs of furnishing and installing all anchor bolts, sleeves, nuts, washers, exhaust pipe assembly with silencer and insulation, and all costs of storing and grouting the unit.

b. The concrete base for the gasoline-electric standby unit will be paid for at the contract unit price for Item 24, "Concrete - Class 'A'". Steel dowels and reinforcement in these bases will be paid for under Item 26, "Steel Reinforcement".

c. Partial payment up to 50 per cent of the contract price will be made when the equipment has been shop tested to the satisfaction of the Contracting Officer and delivered complete at the site of the work.

d. Final payment of the contract price will be made after the field tests are completed to the satisfaction of the Contracting Officer in accordance with Paragraph TP13-9.

e. The payment for all testing shall be included in the contract price for Item 36.

PART IV

SECTION XIV. TRAVELING CRANE, COMPLETE (Item 37)

TP14-1. WORK INCLUDED. - The Contractor shall design and install one traveling crane, complete. The crane shall be mounted on the crane rails in the pumping station ready for operation, in accordance with the drawings and the specifications.

TP14-2. GENERAL DESCRIPTION. - The crane shall be hand-operated, and shall have a working capacity of not less than 5 tons carried on one trolley. The distance from center line to center line of crane rails shall be 22 feet 7 inches. The distance from operating floor to top of crane rail shall be 12 feet 0 inches. Clearance limitations are shown on the drawings.

TP14-3. DETAILED DESCRIPTION. - The crane shall consist essentially of a double I-beam or double box girder bridge mounted on two trucks, each truck having two double-flanged wheels and geared for hand-chain-operated travel, four crane stops for attachment to the crane rails, and a chain-operated traveling trolley provided with an integral, chain-operated, self-locking hoist. The crane shall be similar and equal to the "Shaw-Box", Type "BR", as manufactured by Manning, Maxwell and Moore, Inc., or the two-speed, double beam, Figure 22 Catalogue No. 12-C as manufactured by the Wright Manufacturing Co., Division of the American Chain and Cable Company. The hoisting rope shall conform to the requirements of Federal Specification RR-R-571 for Rope, Wire, Type XXXIII, shall be thoroughly impregnated with a corrosion-resistant lubricant satisfactory to the Contracting Officer, and shall provide for a vertical lift of not less than 37 feet. The operating chains shall provide for hand operation from the engine room floor 12 feet below the top of the crane rail. The hoist drum shall be grooved to receive the wire rope. Provisions shall be made for proper lubrication of all moving parts.

TP14-4. DESIGN. - a. The detailed design of the traveling crane shall be in accordance with the drawings and the specifications. All working parts shall be readily accessible for inspection and repair, properly designed and suitable for the use and service required.

b. The design stress for any member or part of the material covered by these specifications shall be not greater than one-fifth of the ultimate strength of the material used.

TP14-5. DRAWINGS. - The Contractor shall submit for approval detail drawings for the traveling crane he proposes to install, in sufficient detail to check the design. These drawings shall include a complete and itemized list of all parts, with the grade and class of material or make of a standard article, the Contractor proposes to furnish. The item number in the list of parts shall be shown on the drawings by means of a circle enclosing the item number and a solid light line connecting the

circle to the part. Thickness of plates and sizes of structural shapes must be shown either on the part or in the itemized list of parts. Proposed construction shall be clearly shown on the drawings by the liberal use of sections, enlarged details and by other means. Any item or part needed to provide a complete and workable installation in accordance with the intent of these specifications shall be supplied by the Contractor whether or not it is included on the drawings, the list of parts, or in the requirements of these specifications.

TP14-6. MATERIALS AND WORKMANSHIP. - The traveling crane shall be constructed of the grade and class of materials as shown on the "List of Parts" on the design drawings as furnished by the Contractor and approved by the Contracting Officer and shall conform to the provisions of Section VIII, where applicable. All metal workmanship shall be of approved standard quality.

TP14-7. INSTALLATION. - The traveling crane shall be assembled and installed in the pumping station, as shown on the drawings.

TP14-8. INSPECTION AND TESTS. - a. The traveling crane shall be factory tested to a capacity of 6 tons throughout all its functions. The Contractor shall submit to the Contracting Officer certified copies, in triplicate, showing the results of such tests and a statement of chain pull and chain overhaul required to raise the load one foot.

b. The traveling crane shall also be tested by the Contractor in the field under the supervision of the Contracting Officer as soon as practicable after installation. Acceptance will not be made until all tests are completed to the satisfaction of the Contracting Officer.

TP14-9. PAINTING. - Shop painting shall be in accordance with the applicable provisions in Section XVIII. Such retouching as may appear necessary in the opinion of the Contracting Officer shall be done with the same shade of paint as the shop coat. All finished surfaces to be exposed to the atmosphere during shipment shall be coated with a heavy rust preventive compound. Field painting of all exterior parts, except brass, bronze or finished surfaces shall be done in accordance with the provisions in Paragraph TP18-6 d (5) (b).

TP14-10. PAYMENT. - a. Payment for designing, furnishing, installing and painting the traveling crane as specified herein will be made at the contract price for Item 37, "Traveling Crane, Complete", and shall include all necessary accessories.

b. Partial payment will be made as follows: 50 per cent of the contract price will be paid when the traveling crane has been shop tested to the satisfaction of the Contracting Officer and delivered complete at the site of the work.

c. Final payment of the contract price will be made after the field tests are completed to the satisfaction of the Contracting Officer.

d. The cost of all testing shall be included in the contract price for Item 37.

SECTION XV. WATER SUPPLY AND PLUMBING (Item 38)

TP15-1. WORK INCLUDED. - The Contractor shall perform all labor necessary to install and complete the water supply, plumbing system, and circulating system for furnishing cooling water to the gasoline engines, and the hydraulically operated valve control system and drains to sump pump, as shown on the drawings and as directed by the Contracting Officer.

TP15-2. GENERAL. - a. The City of Hartford will furnish and install a water meter. The Contractor shall connect to the City's water service and shall install all required pipe, valves, cocks, and fittings as shown on the drawings and required by these specifications. The Contractor shall submit for approval detailed drawings and data descriptive of the water supply and plumbing fixtures he proposes to install.

b. The furnishing and installing of water heating equipment is included under Item 34. The work under Item 38 shall include water piping to and from the proper tappings in the hot water storage tank.

c. Protection. - All work and materials shall be protected at all times. The Contractor shall make good all damage to existing or new work caused either directly or indirectly by his workmen. Work shall be properly handled and protected to prevent obstruction or damage. All pipe openings shall be closed with caps during installation. All equipment shall be tightly covered and protected against dirt, water, chemicals, or mechanical injury until accepted or otherwise directed by the Contracting Officer.

d. Cutting and repairing. - All cutting necessary for the installation of plumbing shall be done, and all repairs made by skilled mechanics of the trade involved.

e. Arrangement of piping. - The drawings show the general arrangement of all piping. Should local conditions necessitate a rearrangement of same, or if the piping can be installed to better advantage, then the Contractor before proceeding with the work shall prepare and submit drawings to the Contracting Officer for approval, detailing the proposed rearrangement.

TP15-3. MATERIALS. - a. Soil, waste, and drainage lines 2 inches and larger, within the building, shall be extra-heavy, cast-iron soil pipe and fittings. All cast-iron soil pipe shall be uncoated, cylindrical, smooth, and free from cracks, holes, and other defects, and of uniform thickness throughout.

b. Fittings for use with cast-iron pipe shall be of the same grade as the pipes to which they are connected.

c. Engine cooling water waste piping shall be standard weight galvanized genuine wrought-iron pipe. Funnels on the engine cooling water waste shall be made of 16-ounce copper.

d. Waste piping 1-1/2-inch and smaller, except as noted above, and vent piping 2-inch and smaller shall be standard weight galvanized genuine wrought-iron pipe. Short nipples shall be of extra heavy pipe.

e. Fittings in galvanized waste piping shall be galvanized cast iron, recessed drainage type fittings. Fittings in galvanized vent piping shall be galvanized, malleable iron fittings.

f. Hot and cold water piping including the engine cooling water supply piping and the hydraulic-operated valve control system piping shall be 85 per cent red brass of iron pipe size, standard weight. Fittings shall be iron pipe size, malleable pattern brass.

g. All exposed supply and drain piping at plumbing fixtures including traps and all handles and escutcheons shall be chromium plated brass.

h. Pipe sleeves shall be of extra-heavy wrought-iron pipe.

TP15-4. PIPE JOINTS. - a. Cast iron. - The cast-iron soil pipe joints shall be calked solid with oakum packing and then filled with lead. Connections between threaded pipe and soil pipe shall be similar, and the threaded pipe shall have a ring or half a coupling screwed on to form a spigot.

b. Water pipe. - Threaded joints shall be made with tapered threads and an approved pipe joint compound applied to threaded end of pipes only. Joints in lead pipe shall be wiped solder joints. All joints between cast-iron and lead pipe shall be made with cast-brass ferrules, calked into the hub of the iron pipe and wiped.

TP15-5. PIPING INSTALLATION. - a. General. - All piping shall be installed parallel with the lines of the building unless otherwise distinctly shown or noted on the drawings. All piping shall be installed in chases, wall spaces, furred wall spaces, and in furred ceilings as far as practicable. All pipes shall be cut accurately to measurements established at the building by the Contractor and shall be worked into place without springing or forcing. Care shall be taken not to cut or weaken the structural portions of the building. Proper allowances shall be made for expansion and contraction of the pipe. Swing joints, turns, or long offsets shall be provided wherever necessary to allow for expansion. The Contractor shall provide proper anchorage to prevent vibration and creeping. Cold and hot water risers shall be anchored at floors where necessary, with proper provision for expansion of hot water risers.

b. Soil, waste, and vent piping. - Horizontal soil and waste pipes, for the sanitary waste system, shall be given a grade of one-fourth inch per foot where possible, but in no case less than one-eighth inch per foot. All changes in pipe size on soil, waste, and drain lines shall be made with appropriate long-turn fittings. Short-radius fittings shall be used only with the specific authority of the Contracting Officer. Sanitary vents may be interconnected where practicable, and such connection shall be made at least two feet above the highest fixture connection to prevent the use of any vent line as a waste.

c. Water service piping. - The water service branch shall be extended inside the building where a gate valve and drain shall be installed, and the piping extended to all fixtures, outlets, and equipment (see Paragraph TP15-2 a). All water pipe shall be properly graded to drain to a point where the entire system, including all piping and equipment, can be emptied, and the cold water system shall be graded toward the shut-off valve. No portions of the hot or cold water system shall trap water which cannot be drained, and drains shall be installed at all low points. Drains shall consist of hose bibbs.

TP15-6. SANITARY PIPING ACCESSORIES. - a. Flashings. - Openings in roof for vent pipes shall be flashed with 6-pound lead conforming to Federal Specification QQ-L-201, Grade B (see Paragraph TP7-6 c (3) (f)). Flashing shield shall extend not less than 10 inches from the vent in every direction, and shall be mopped in with the roofing felt to make a watertight installation.

b. Traps. - A trap shall be provided for each fixture and piece of equipment requiring connection to the sanitary system.

c. Cleanouts shall be installed where indicated or directed. Cleanouts shall be the same size as pipe except that cleanouts larger than 4 inches will not be required. Cleanouts in floors shall in all cases be flush with the finished floor and have countersunk plugs or covers. Threads on cleanout plugs shall be made up with graphite.

d. Sleeves. - Extra heavy wrought-iron pipe sleeves shall be provided where pipes pass through masonry or concrete walls or floors. Sleeves shall provide sufficient clearance for the pipe passing through, and, where located in outside walls or floors of rooms below grade, shall be made watertight in a manner approved by the Contracting Officer.

e. Floor plates shall be provided where exposed pipes pass through floors, walls, or ceilings. The plates shall be nickel-plated brass, similar and equal to Crane Company's B. & C., No. 10.

TP15-7. VALVES, UNIONS AND HOSE BIBBS. - a. Gate valves shall be 200-pound working pressure, all bronze, with screwed ends and stationary spindles.

b. Stop and waste valves shall be rough brass, compression type.

c. Unions. - On all brass piping the unions shall be cast brass or bronze. On all other piping, unions shall be galvanized malleable iron screw with ground bronze joint seats.

d. Hose bibbs shall be 3/4-inch rough brass, loose-key, compression type.

e. Four-way valves, for the hydraulic-operated valve control system, shall be similar and equal to the Walworth, Class 150, Steeliron Lubricated Plug Valve No. 1734 screw type. The four-way valves shall be provided with a specially designed operating wrench with pointer to indicate the position of the plug.

TP15-8. PRESSURE REDUCING VALVES. - a. A pressure reducing valve shall be installed in the engine cooling water system and shall be so arranged and adjusted that cooling water will be delivered to the engines at a pressure not greater than 15 pounds per square inch.

b. A pressure reducing valve shall be installed in the water supply to the pumping station and shall be so arranged and adjusted that water in the pumping station with the exception of the water supply for the operation of the hydraulic valves will be approximately 45 pounds per square inch. The water supply for the operation of the hydraulic valves shall be at full city pressure.

c. Pressure reducing valves shall operate satisfactorily under a variable initial pressure of from 75 to 150 pounds and shall maintain a constant delivery pressure as specified above. All metal parts of the valves shall be of bronze except the steel springs and cap screws which shall be specially treated to prevent rusting. The valves shall have renewable composition seats.

TP15-9. ENGINE COOLING-WATER CONNECTIONS. - The water supply connection to each engine shall be made with a 12-inch long section of brass or bronze flexible metal hose similar and equal to that manufactured by the Chicago Metal Hose Corporation or the Packless Metal Products Corp. The waste connection to each engine shall be an open connection using a funnel, as shown on the drawings. Funnels shall be made of 16-ounce copper, with a beaded top, 9 inches diameter and 9 inches high, and shall not be painted.

TP15-10. FLOOR DRAINS shall be "Josam" No. 5423-B-X, or equal, with sediment bucket and bottom outlets of size indicated. Diameter of strainer shall be approximately three times the size of the outlet. Floor drains shall be provided with chromium-plated brass top. Area drains shall be "Josam" No. 5204, or equal, with removable dome strainers and sediment cup. Drains for chimneys shall be "Josam" No. 8041-1/2, or equal. Drain for intake chamber shall be "Josam" 5322, or equal.

TP15-11. PIPE COVERING. - All hot water piping shall be insulated with 1-inch, wool-felt, sectional covering, asbestos lined, with 8-ounce canvas jacket, sewed in place. All covering shall be neatly finished and free from cracks or irregularities. Fittings and valves in covered lines shall be covered with a 1-inch thickness of asbestos plastic and shall be canvas-jacketed.

TP15-12. SUPPORTS AND FASTENINGS. - a. All horizontal piping shall be supported on approved type pipe hangers and brackets designed to allow for expansion of the piping and to permit vertical adjustment.

b. All overhead cast-iron soil, waste, and drainage lines shall have supports not more than 5 feet apart. Vertical lines shall be adequately supported at each floor by means of approved clamp type supports. All other pipe shall have supports not more than 10 feet apart for pipe larger than 1-1/2-inch, and 8 feet apart for pipe 1-1/2-inch and smaller and at lesser intervals wherever necessary to prevent sagging.

TP15-13. FIXTURE CONNECTIONS. - a. All equipment and fixtures shall be carefully assembled, installed where indicated on the drawings, and connected to the required plumbing outlets, so that the equipment will be ready for operation when completed.

b. The connection between earthenware or any fixtures and flanges on soil pipe shall be made absolutely gas- and watertight with a closet-setting compound of gaskets.

TP15-14. PLUMBING FIXTURES, FITTINGS, AND TRIMMINGS. - a. General. - The Contractor shall install all plumbing fixtures as specified herein and as noted on the drawings. All manufactured items shall be furnished in strict accordance with this specification. All materials shall be new and free from defects.

b. Materials. - (1) Vitreous china. - All vitreous fixtures shall be of "first quality" white vitreous china conforming to Federal Specification WW-P-541a.

(2) Cast-iron enameled ware shall comply with the applicable provisions of Federal Specification WW-P-541a.

c. Fixture fittings. - Except where otherwise specified under the separate fixture items, all fixture supply fittings shall be made of chromium plated brass. Valve seats shall be renewable. Handles may be either the cross or the lever type. Chromium plated supply pipes shall be furnished with the supply fittings. Combination or double type faucets for lavatories may be of the exposed body or concealed body pattern. The exposed body patterns may be furnished in a single casting or as a factory-assembled unit with separate faucets and connecting pipes. All drain plugs shall be made entirely of chromium plated brass,

and shall have brass tailpieces, approximately 4 inches long with slip joint connections. Lavatory drain plugs shall have cross bars, overflow openings, 1-1/4-inch diameter tailpieces, and minimum 1-inch openings for stoppers. Each fixture shall be supplied with a trap as specified under the separate fixture items. All exposed traps shall be chromium-plated brass with cleanout plugs. Traps shall be provided with washers, heavy nuts for slip joint connections, and standard internal pipe thread at outlets. The traps shall provide a water seal not less than two inches in depth.

d. Flush valves shall conform to Federal Specification WW-P-[illegible]a. Each flush valve shall be provided with a cut-off cock or stop valve immediately adjacent thereto. The body of the stop valve shall be chromium plated brass; moving parts shall be brass and the stop valve handle shall be of the lock-shield type. A metal-to-metal union joint or a threaded adjustable connection with jam nuts and washer shall be provided between the flush valve and the cut-off cock or stop valve. The cut-off cocks or stop valves shall be provided with rubber bumpers to protect the water closet seats. Flush pipe shall be furnished with the flush valve and shall be of chromium plated brass. The supply connections shall be minimum 1-inch I.P.S. Flush pipe connection shall be minimum 1-1/4-inch O.D.

e. Backflow preventers. - Each flush valve shall be supplied with a backflow preventer of the moving part and air vent type which shall be of such size and proportions as to allow an ample flow of water to the fixtures. Backflow preventers shall be of brass, and shall be a complete functioning unit, installed separately or contained wholly within the flush valve body, between the flush valve mechanism and the fixture. When water is not flowing from the flush valve, the moving part or parts shall be actuated by the flowing water and moved into a position that opens the water passage and closes the air vent tightly; and when flow of water stops, the moving part or parts shall return automatically to the normal position of rest. The cycle of motion shall be completed in full with each completed operation of the flush valve, and without the aid of springs or other elastic or flexible part. The operation shall be positive and dependable.

f. Types of fixtures. - The following items specify the types of fixtures which shall be furnished with fixture fittings and trimmings as specified. Each item shall be of the size and type specified, and shall have wall or floor outlet as indicated. References made herein to outfit numbers, paragraphs, patterns, and figures for vitreous china and enameled cast iron plumbing fixtures are "Standard" as manufactured by the American Radiator-Standard Sanitary Manufacturing Co. Equal fixtures of reputable manufacture may be substituted as approved by the Contracting Officer. All fixtures shall be designed to prevent the backflow of polluted water or waste into the water supply system. All fittings installed on fixtures in the building shall have chromium plated finish.

(1) Lavatories. - "Hibben", F-257-S, vitreous china lavatory and leg, square bowl, and wall brackets with B709 combination supply and pop-up drain fitting, 3/8-inch supply pipes, and 3/8-inch B1606 stops, and B-964, 1-1/4-inch S trap. All exposed metal shall be chromium plated.

(2) Water closets (wall outlet). - "Neolo", F2525VS, Angle back and base, syphon jet elongated closet with top inlet and wall outlet. Sloan "Royal" No. 110 FYV flush valve with vacuum breaker, Church "Sani-Black" seat No. 2500, closet screws, cups, and washers.

(3) Water closets (floor outlet). - "Neolo", F2521 VS, Angle back and base, syphon jet elongated closet with top inlet and floor outlet. Sloan "Royal" No. 110 FYV flush valve with vacuum breaker, Church "Sani-Black" seat No. 2500, closet floor screws, cups, and washers.

(4) Urinals. - "China", F-6023L, 18-inch vitreous china urinal battery, F6026 seam covers - 6-inch, B2024 strainer, and F4100 (No. 1) vitreous china tank with top supply automatic fittings. Piping and tank shall pass through wall with chromium plated elbows and plates made tight at each urinal.

(5) Service sinks. - "Argo", P7705, cast iron, enameled with wall hanger, cast brass chromium finish rim guard bolted to rim, P 7780 trap standard with vent, B 927 double sink faucet, and B 997E plug with metal grid.

TP15-15. ALTERNATE EQUIPMENT AND MATERIALS. - Plumbing materials, fixtures, and equipment differing slightly from those specified herein may be submitted, provided the Contractor clearly states such differences. If the materials, fixtures, and equipment offered are, in the opinion of the Contracting Officer, equal to or better than those specified, they will be given consideration for installation. When no statement of such departure is made, it will be understood that materials, fixtures, and equipment, in strict accordance with the specifications, are being furnished.

TP15-16. TESTS. - a. Defects. - All defects disclosed in the equipment or work by the following specified tests or otherwise shall be made good or the equipment or work replaced without additional cost to the Government.

b. Instruments, pumps, etc. - All testing instruments, force pumps, gages, smoke equipment, etc., shall be provided by the Contractor.

c. Plumbing and drainage system. - The entire system of soil, waste, drain, and vent piping shall be tested with water and smoke and proven tight to the satisfaction of the Contracting Officer before trenches are backfilled, piping covered, or fixtures connected.

(1) Water tests. - The connection from building to sewer and the drainage system below floors or ground level shall be filled with water to top of vertical section of pipe 10 feet high and the water allowed to stand for at least 30 minutes for inspection, after which, if the lines prove tight, the water shall be drawn off and the trenches backfilled. The soil, waste, and vent piping above the floor or ground level shall have the openings plugged where necessary and the piping system above filled with water to the level of the top of vent pipes and allowed to stand for at least 24 hours for inspection, after which, if the lines prove tight, the water shall be drawn off and the fixtures connected.

(2) Smoke tests. - After all fixtures have been permanently connected, a smoke test shall be applied to the sanitary system and the entire system proven tight, to the satisfaction of the Contracting Officer, when filled with smoke under pressure equal to one inch of water.

d. Tests on water supply system in building. - The entire water system shall be tested to a hydrostatic pressure of 200 pounds per square inch and proven tight for a period of one hour at this pressure. Water piping, if in any way concealed by structural work, shall be tested to the above pressure and proven tight before pipes are concealed.

TP15-17. CLEANING AND ADJUSTING. - a. At the completion of the work, all parts of the installation shall be thoroughly cleaned. All equipment, pipe, valves, and fittings shall be cleaned of grease, metal cuttings, etc., and sludge which may have accumulated by operation of the system for testing. Any stoppage or discoloration or other damage to parts of the building, its finish or furnishings, due to the Contractor's failure to clean the piping systems properly, shall be repaired by the Contractor at no additional expense to the Government.

b. All flush valves and other parts of the work shall be adjusted for quiet operation and all automatic control devices shall be adjusted for proper operation.

TP15-18. GUARANTEE. - a. The Contractor shall guarantee all materials and equipment furnished and installed by him to be free from defects, and shall further guarantee that all equipment installed is capable of performing at manufacturer's maximum established rating.

b. The Contractor shall replace any part, or parts, or equipment as a whole, furnished and installed by him, found to be defective or incapable of performing at maximum established rating, within the period of the guarantee, without additional expense to the Government.

c. The period of guarantee shall extend for one year from date of acceptance of the pumping station.

TP15-19. PAYMENT. - a. Payment will be made at the contract price for Item 38. "Water Supply and Plumbing". Payment shall include all costs for furnishing, installing, testing, and placing the water and sanitary systems in service as herein specified and as shown on the drawings, and shall include plumbing fixtures and other expenses incidental thereto,

b. Payment will be made after the water supply and plumbing have been furnished, installed, tested and placed in service to the satisfaction of the Contracting Officer.

PART IV

SECTION XVI. MISCELLANEOUS EQUIPMENT (Items 39 to 44 inclusive)

TP 6-1. CARBON DIOXIDE FIRE EXTINGUISHING EQUIPMENT (Item 39). - a. W... included. - The Contractor shall install a complete manually operated carbon dioxide fire extinguishing system for the protection of the three gasoline engines and the gasoline-electric generating unit. The system shall be installed as indicated on the drawings and shall consist essentially of the following equipment:

4 - 50-pound capacity cylinders of carbon dioxide
1 - Scale and accessories
1 - Steel angle frame assembly with wire mesh enclosure
4 - 1/2-inch manually operated directional valves with cast bronze name plates
2 - Manually operated remote control stations
1 - 3/4-inch pipe header
1 - Set 1/2-inch branch piping to each engine
1 - Spare parts kit and operating instructions

In addition to the above, there shall be furnished two portable, 15-pound carbon dioxide fire extinguishers, each with 3 feet of hose, and a permanent shut-off of the seat type. Each portable extinguisher shall be mounted on a wall bracket at the location shown on the drawings. The equipment shall be similar and equal to that manufactured by Walter Kidde and Company or the C-O-Two Equipment Company. The Contractor shall submit for approval detailed drawings and data descriptive of the carbon dioxide fire extinguishing equipment he proposes to install. The Contractor shall also provide two test cylinders for testing the system in addition to the four cylinders supplied with the installation.

b. Cylinder battery. - (1) The cylinder battery shall consist of a bank of four 50-pound capacity carbon dioxide cylinders assembled in a framework and arranged so they can be weighed without removing them from the framework and without putting the system out of service. The cylinders shall stand in their normal upright position and shall be properly guarded with removable wire mesh screening.

(2) Each cylinder shall be equipped with a cylinder valve having a 1-inch I.P.S. American Standard tapered thread, screwing into the cylinder. A syphon tube, having a clear hole diameter of 7/16 inch, plus or minus 1/64 inch, shall extend from valve approximately to the base of the cylinder so that liquid carbon dioxide is taken from the cylinder. The cylinder valve shall be made of forged brass of sufficient strength to withstand a test pressure of 3,000 pounds per square inch without distortion. Each valve shall be equipped with a safety disc made of rolled gold on a copper metal base, for the purpose of releasing the gas in the cylinder at excessive temperatures.

(3) To each cylinder valve shall be attached a cutter valve, housing a hollow tubular cutter, the advance of which serves to cut a clean hole through the safety disc to permit the carbon dioxide to discharge. Advance of the cutter shall be caused by the rotation of a lever approximately 6-1/2 inches long. The maximum force necessary to effect rotation of this lever shall be 15 pounds per cylinder.

(4) The outlet of each cutter valve shall be connected by means of a flexible metal loop to a common manifold. The connecting tee at the manifold shall have as an integral part a check valve to prevent loss of gas in the event that one or more cylinders are disconnected from the manifold at a time when gas is discharged. The arrangement must be sure that premature discharge of the gas in one cylinder will not cause the discharge of gas in the other cylinder.

c. Piping system. - (1) A suitable piping system shall be provided to convey the carbon dioxide from the cylinder battery to the space protected. The gas shall be discharged through suitable shielded type outlets, specially designed to discharge the gas in such a manner as to eliminate turbulence, prevent the entrainment of air, and produce the maximum amount of carbon dioxide "snow" without possibility of freeze-up. All piping leading from the cylinder valves to the engine bases shall be hot-dipped, galvanized, seamless, steel pipe conforming to A.S.T.M. Designation A 120-44. Sizes up to and including 3/4 inch shall be standard weight, and sizes above 3/4 inch shall be extra-heavy. Unions shall have steel to bronze seats. Distribution piping and its supports at each engine shall be extra-heavy polished brass pipe. The distribution system shall include the pipe through the engine room floor. All fittings shall be extra-heavy cast bronze, having a bursting pressure not less than 6,000 pounds per square inch.

(2) The system shall be so arranged that two carbon dioxide cylinders are connected and ready for use at all times and the other two are connected for reserve use in the event the contents of the first two cylinders are exhausted. Two break glass pull boxes shall be provided and mounted as shown on the drawings, each pull box controlling two cylinders. Each pull box shall consist of a pull handle which is connected through suitable corrosion-resisting cable to the releasing device at the cylinders. The cable shall be inserted in 3/8-inch I.P.S. conduit and enclosed corner pulleys shall be installed at all right-angle bends. The entire system shall be installed in accordance with the recommendation of the manufacturer.

d. Floor, wall, and ceiling plates. - The provisions of Paragraph TP15-6 e shall apply.

e. Payment. - (1) Payment will be made at the contract price for Item 39, "Carbon Dioxide Fire Extinguishing Equipment".

(2) Payment will be made after the carbon dioxide fire extinguishing equipment has been furnished, installed, tested and placed in service to the satisfaction of the Contracting Officer.

(3) The cost of all testing shall be borne by the Contractor and shall be included in the contract price for Item 39.

TP16-2. SUMP PUMP (Item 40). - a. Work included. - The Contractor shall install one vertical centrifugal sump pump of the submerged type with discharge piping as indicated on the drawings. The Contractor shall submit for approval detailed drawings and complete data descriptive of the sump pump, float switch and piping, which he proposes to install.

b. Description. - (1) Pump. - The pump shall have a capacity of 100 gallons per minute against a total head of 40 feet. The pump shall have a cast iron casing and a bronze impeller of either the closed or open type capable of passing coarse or fibrous material. The shaft shall be of stainless steel enclosed in a wrought-iron pipe support. The upper bearing shall be of the combined radial and thrust type, grease-lubricated, anti-friction bearing. The lower and intermediate bearing shall be made up of a non-seizing, non-scoring high lead-bronze bearing bushing with a grease reservoir. The reservoir shall be connected through suitable piping to an Alemite or Zerk fitting over the pit cover. The pump shall be bolted or welded to a small cover plate which in turn shall be bolted to the sump pit cover.

(2) Motor. - The pump shall be driven by a 110-volt, single-phase, 60-cycle, 1750-r.p.m. vertical, drip-proof, induction motor with low starting current and normal starting torque characteristics. The motor shall be rated not less than 1-1/2 horsepower with a limiting temperature rise of 40 degrees Centigrade, and shall have Class "A" insulation and in addition an insulation known to the trade as "dyehouse" insulation.

(3) Float switch. - The motor shall be actuated by a float switch mounted on a stand and a combination magnetic starter mounted on the wall. The starter shall be equipped with thermal overload protection and shall be similar and equal to General Electric Company's CR-7008, C 40 E, NEMA size 0 cast iron, watertight, type 4 enclosure. The float switch shall be furnished with a cast iron enclosure.

c. Payment. - (1) Payment will be made at the contract price for Item 40, "Sump Pump".

(2) Payment will be made after the sump pump has been furnished, installed, tested and placed in operation to the satisfaction of the Contracting Officer.

(3) The cost of all testing shall be borne by the Contractor and shall be included in the contract price for Item 40.

TP.6-3. GASOLINE TANK AND PIPING (Item 41). - a. Work included. - The Contractor shall install one gasoline storage tank together with fill and vent pipes, gasoline gage, and supply and drain piping to the gasoline engines and gasoline-electric standby unit as shown on the drawings. The Contractor shall submit for approval detailed drawings and data descriptive of the gasoline tank, piping and gage which he proposes to install.

b. Tank. - The gasoline tank shall be of welded steel construction, and shall comply with the legal requirements of the City of Hartford, Connecticut.

c. Piping. - All piping outside the pumping station shall be wrought iron pipe conforming to Federal Specification WW-P-441a. Fittings shall be malleable iron screwed fittings conforming to Federal Specification WW-P-521b. All gasoline piping inside the pumping station shall be soft copper tubing conforming to Federal Specification WW-T-799, Type K, installed with flared fittings. The foot valves on the suction lines inside the gasoline tank shall be of the single poppet type similar and equal to No. 438 manufactured by the Amco Corporation. The vent pipes shall be securely clamped to the building wall. All piping through beams, floor and outside walls shall be set in extra heavy wrought-iron pipe sleeves, except the outside wall sleeves shall also be calked with lead. All pipe installed shall be perpendicular or parallel to building walls. Piping shall be supported on hangers or clips spaced at eight-foot intervals and shall have a continuous pitch toward tanks. Lock type caps shall be furnished.

d. Gage. - The gasoline gage shall be installed on the wall of the engine room as shown on the drawings. It shall be capable of indicating the amount of gasoline in the storage tank and shall be of the automatic remote-reading type, similar and equal to that manufactured by the Liquidometer Corporation of Long Island City, New York. It shall be float-operated, the motion of the float operating against bellows of a closed hydraulic system. The system shall be filled with a liquid for the purpose of transmitting the motion of the float to the indicator bellows. The indicator shall be installed in a protecting case not less than 12 inches by 12 inches and provided with a scale graduated to 2930 gallons. The flexible hydraulic tubing shall be protected by a metallic armor for connecting the indicator with the float mechanism. The connection between the gasoline tank and gage line shall be protected by a structural steel box of suitable size.

e. Floor, wall, and ceiling plates. - The provisions of Paragraph TP15-6 e shall apply.

f. Payment. - (1) Payment will be made at the contract price for Item 41, "Gasoline Tank and Piping".

(2) Payment will be made after the gasoline tank and piping has been furnished and installed, tested and placed in operation to the satisfaction of the Contracting Officer.

(3) The cost of all testing shall be borne by the Contractor and shall be included in the contract price for Item 41.

TP16-4. DIESEL FUEL TANK AND PIPING (Item 42). - a. Work included.- The Contractor shall convert the existing gasoline storage tank, furnished by the Government, to a diesel fuel storage tank with fuel gage and piping arranged as shown on the drawings. The Contractor shall submit for approval detailed drawings and data descriptive of the fuel gage he proposes to install.

b. Tank. - The tank is located adjacent to the north-east wall of the existing temporary pumping station, and has approximately two f[illegible] of earth cover. The Contractor shall remove the tank, drain all gasoline, thoroughly clean and relocate the tank. All paint shall be removed from the exterior of the tank and the metal thoroughly scraped and cleaned of scale and rust. The tank shall be given two coats of zinc-chromate primer and two coats of paint for underwater steel structures similar and equal to Detroit Graphite Company's "Iron Gard". The Contractor shall install a new manhole cover on the tank, and all piping shall be connected to the top of the tank as shown on the drawings.

c. Piping. - All piping outside the pumping station shall be wrought-iron pipe conforming to Federal Specification WW-P-441a. Fittings shall be malleable-iron screw type conforming to Federal Specification WW-P-521b. All fuel oil piping inside the pumping station shall be soft-annealed copper tubing conforming to Federal Specification WW-T-799, Type K, installed with flared fittings. Piping through beam, floor and exterior wall shall be set in extra-heavy, wrought-iron pipe sleeves, and the exterior wall sleeves shall also be calked with lead.

d. Gage. - The Contractor shall install a fuel gage on the wall of the engine room as shown on the drawings. The gage shall be of the automatic remote reading type similar and equal to that manufactured by the Liquidometer Corporation of Long Island City, New York. The gage shall be of the same type and manufacture as specified in Paragraph TP16-3 d. The indicator shall be installed in a protecting case not less than 12 inches by 12 inches and provided with a scale graduated in gallons to 1000 gallons. The gage tubing from tank to indicator shall be protected by metallic armor and shall be installed in 2-inch [illegible]ectrical conduit. The connection at the tank shall be protected by a heavy structural steel box of suitable size.

e. Floor, wall and ceiling plates. - The provisions of Paragraph TP15-6 e shall apply.

f. Payment. - (1) Payment will be made at the contract price for Item 42, "Diesel Fuel Tank and Piping".

(2) Payment will be made after the diesel fuel tank and piping has been installed complete, tested and placed in operation to the satisfaction of the Contracting Officer.

(3) The cost of all testing shall be borne by the Contractor and shall be included in the contract price for Item 42.

TP16-5. FLOAT GAGE (Item 43). - a. Work included. - The Contractor shall install a float gage of the recording type. The Contractor shall submit for approval detailed drawings and data descriptive of the gage and accessories which he proposes to install.

b. Description. - The float gage shall be similar or equal to Model FD-2 as manufactured by Julien P. Friez & Sons, Inc., Baltimore, Maryland. The recorder shall be designed for recording data for daily periods. The float, tape, and counterweight shall be made of corrosion-resisting metal. The device shall be mounted on a suitable table or bench provided with a baked enamel wire protection grille for float and counterweight tapes and clock weight. The float well and counterweight well shall be of standard weight, genuine wrought-iron pipe.

c. Payment. - Payment will be made at the contract price for Item 43, "Float Gage".

TP16-6. RUBBISH HOIST AND SIDEWALK DOORS (Item 44). - a. Work included. - The Contractor shall install, where shown on the drawings, and in strict accordance with manufacturer's instructions, one electrically operated telescopic hoist similar and equal to the model E.W.D. as manufactured by the Potts Ash Hoist Corporation. The motor shall be explosion-proof type and shall be capable of operating on 110-volt, single-phase, 60-cycle, A.C. power.

b. Description. - The hoist shall be the grade-level type, revolving on ball bearings, having a working capacity of 500 pounds with a hoisting speed of 60 feet per minute and designed to lower by gravity. The sidewalk doors shall be standard flush watertight sidewalk doors similar and equal to sidewalk doors as manufactured by the Potts Ash Hoist Corporation. The doors shall be constructed with diamond pattern plate steel leaves reinforced on the under side with angle irons and equipped with heavy bronze hinges with stainless steel hinge pins, channel iron frame and angle condensation gutter tapped for 3/4-inch drain pipe. Two 17-inch diameter by 24-inch high swing bail cans shall be furnished with the hoist and doors. The cans shall be of 16-gage galvanized iron reinforced at top and bottom with 1-1/4" x 1/4" steel bands, heavily riveted. The 3/4-inch drain pipe shall be run from the condensation gutter through the screening chamber floor as shown on the drawings.

c. Painting. - The equipment shall be painted in accordance with the applicable provisions of Section XVIII.

d. Payment. - (1) Payment will be made at the contract price for Item 44, "Rubbish Hoist and Sidewalk Doors", and shall

include all costs for furnishing, installing, and testing the rubbish hoist, sidewalk doors and appurtenant equipment as specified and shown on the drawings.

(2) Payment will be made after the rubbish hoist and sidewalk doors have been furnished and installed complete, tested and placed in operation to the satisfaction of the Contracting Officer.

PART IV

SECTION XVII. INSTALLATION AND TESTING OF EQUIPMENT FURNISHED BY THE GOVERNMENT (Item 45)

TP17-1. WORK INCLUDED. - a. The Contractor shall install, under Item 45, the following equipment to be furnished by the Government:

(1) Three 30-inch volute pumps with sole plates and bolts.

(2) One 16-inch volute pump with sole plate and bolts.

(3) Three gasoline engines with silencers and flexible exhaust connections.

(4) One Diesel engine with silencer and flexible exhaust connection.

(5) Four right angle gear units with sole plates and bolts.

(6) Pump intake and discharge piping, including valves and couplings.

(7) Dowels for the pump and gear unit sole plates.

b. The work of the installation of equipment to be furnished by the Government will be inspected during installation by the Contracting Officer, and the Contractor shall furnish competent supervisors to direct the installation of this equipment. The Government will provide the services of a representative of the equipment manufacturer to inspect and check the installation of equipment at such times as the Contracting Officer deems such services are required.

TP17-2. DELIVERY. - a. The equipment to be furnished by the Government will be available within 450 calendar days after the date of receipt by him of notice to proceed, and the Contractor will be given 10 days notice before arrival of the equipment furnished by the Government.

b. The pumps may be stored outdoors provided that the pump intake and discharge openings are blocked, all bearings are protected against the intrusion of dust and moisture and all finished surfaces are protected against corrosion. The engines and the gear units shall be stored in a suitable warehouse until they are installed in the work. The engines and gear units shall not be placed in the pumping station until the walls and roof are completed, and the windows and doors are installed.

TP17-3. ANCHOR BOLTS. - a. The Contractor shall install all anchor bolts, nuts, sleeves and washers required for the installation

of the equipment furnished by the Government (see Paragraph TP8-5 b). Within 60 days after the date of receipt by the Contractor of notice to proceed, the Contracting Officer will furnish the Contractor detailed drawings showing the size and locations of all anchor bolts and sleeves that will be required for the equipment. Each anchor bolt shall be threaded at both ends and shall be provided with sleeves, nuts and washers as shown on the drawings.

b. A rigid template made of 2" x 6" wood plank shall be used for the setting of the anchor bolts. Holes for the anchor bolts shall be accurately bored in the template and of such size that the bolts will fit tightly into the holes. After the anchor bolts, washer and sleeves are assembled on the underside of the template, the top nut shall be screwed on tightly against the upper side of the template. The bolts shall be cast into the concrete while being held rigidly in the template.

TP17-4. INSTALLATION. - The Contractor shall install, erect, attach or build into the structures all the machinery, piping, and other metal work furnished by the Government or required for the work, in a workmanlike manner as shown on the drawings or directed by the Contracting Officer. Wherever possible, all parts shall be made accurately to standard gage to facilitate replacement and repair. All work of the installation of the equipment shall follow the best modern practice in the installation of machinery of this type. All work of installation shall be done by mechanics skilled in the installation and alignment of heavy equipment. The equipment shall be anchored to concrete foundations by means of steel anchor bolts. The anchor bolts shall be set with the use of a template at the time of placing the concrete foundations as shown on the detailed drawings of the pumps, gear units and engine bases. The concrete foundations for the equipment shall be constructed to the dimensions shown on these drawings or as recommended by the equipment manufacturer and shall be securely attached to the structural concrete floor slab by means of steel dowels. The equipment shall be given a touch-up coat of paint as required before finish paint is applied (see Section XVIII).

TP17-5. PUMPS, GEAR UNITS, DISCHARGE PIPING, VALVES AND ACCESSORIES. - a. Three 30-inch volute type pumps and one 16-inch volute type pump complete, intake and discharge piping, valves, gear units, anchor bolts and accessories shall be installed in the pumping station at the locations as shown on the drawings. The complete pumping units shall be set accurately plumb and level and anchored to the concrete floor slab by means of anchor bolts. The Contractor will be required to grout in the wall section of each pump after the pump is completely assembled. The anchor bolts shall be set at the time the concrete is placed. The gate valves and horizontal piping shall be supported by concrete piers as shown on the drawings.

b. The Contractor shall construct a box form in the concrete walls for the installation of intake and discharge wall castings (see Paragraph TP6-16 c). Embedding of these castings, as

the walls are placed, will not be permitted. The pumps, valves, flexible connections, intake and discharge piping shall be assembled with all bolts on the piping installed and tightened. The pumps shall be set and bolted to the sole plates. The Contractor shall provide steel wedges and shims for the purpose of leveling the pumps. The wedges shall be approximately 6 inches long, 2-1/2 inches wide and 1/2 inch thick, tapered to a feather edge. The pumps shall be set so that, when checked by the Contracting Officer, by placing a machinist's level on the half-coupling on the pump stub-shaft and rotating the pump shaft, there will be no movement of the bubble in the level as the shaft is rotated.

c. After the pumps are properly set, but before the pumps and wall castings are grouted, the gear units, vertical shafts, and engines shall be set on their anchor bolts and checked for proper alignment, to the satisfaction of the Contracting Officer. The section of shaft on top of the pumps shall then be removed and the pump settings rechecked. When the pumps are properly set, all piping and flexible connection bolts tightened, and exposed ends of wedges cut off, the pump bases and wall castings shall be grouted. The grout for the pump bases shall be of non-shrinking cement, similar and equal to "Embeco" (see Paragraph TP10-14). The grout shall be well worked beneath all parts of the sole plates and then built up around and to the top of the sole plates. When the grout has attained its initial set, it shall be rubbed to a smooth finish. The concrete piers shall then be built under the valves and piping, as shown on the drawings.

d. The Contractor shall assemble the gear units, gear unit sole plates and vertical shafting on each pump. Flexible and rigid couplings shall be thoroughly cleaned with gasoline before they are assembled. The bolts on the flexible couplings shall be carefully and evenly tightened. The gear units shall then be properly aligned by the use of shims and wedges as specified in subparagraph b above. Maximum misalignment of the flexible couplings between pump and gear unit shall not exceed .005 inch in either an angular or parallel direction, as checked by a dial indicator. After the units have been properly aligned, the sole plates shall be grouted as specified in subparagraph c above. The steady bearing plates shall then be doweled to the steady beam with No. C tapered dowels.

TP17-6. ENGINES. - a. The Contractor shall install the three gasoline engines and the diesel engine with silencers and flexible exhaust connections in the pumping station at the locations shown on the drawings. The Contractor shall furnish and install the exhaust piping system and the insulation on all silencers, and the exhaust piping system, and all necessary supports and hangers for the complete exhaust system.

b. The engines shall be aligned with the gear units by means of shims and wedges (see Paragraph TP17-5 b), with a maximum misalignment not exceeding .005 inch in either an angular or parallel direction. The engines shall be grouted as specified in Paragraph TP17-5 c.

c. The Government will furnish four silencers and four flexible water-cooled exhaust connections for the engine exhaust systems. The Contractor shall furnish and install the required exhaust piping assembly, complete with piping, expansion joints, bolts, nuts and gaskets as shown on the drawings. The expansion joints shall be similar and equal to the internally guided expansion joint as manufactured by the American District Steam Co., North Tonawanda, N. Y. Exhaust piping shall be wrought iron conforming to Feceral Specification WW-P-441a.

d. The Contractor shall furnish and install straps and miscellaneous fittings required to support or hang the silencers and exhaust piping as shown on the drawings.

e. The Contractor shall furnish and install on all exhaust pipe assembly, including silencers as shown on the drawings, two 1-inch thicknesses of insulation similar and equal to Keasbey & Mattison "Hy-Temp", Johns Manville "Superex", or Carey "Hi-Temp", with an 8-ounce sewed canvas jacket. Block insulation or 2-inch thick pipe insulation will not be acceptable. All joints shall be staggered and sealed with high-temperature cement plaster. The canvas jacket shall be cut back 2 inches from all exposed metal surfaces. Where canvas jacket is cut back, the insulation shall be covered with asbestos paper extending under the canvas and to the exposed metal surface.

f. Storage battery and battery tray shall be installed on each engine base. All expansion shields and miscellaneous fittings necessary to securely mount the trays shall be furnished and installed by the Contractor.

TP17-7. OPERATION OF EQUIPMENT. - a. The Contractor shall place in operation all of the equipment furnished by the Government. All grease fittings, oil cups, and crankcases shall be filled with the proper lubricant to their operating levels.

b. All shafting and finished metal surfaces shall be thoroughly cleaned and covered with a thin film of rust preventative compound.

c. Each pump shall be run for eight hours continuously at rated load. If river conditions do not permit recirculating the water for testing purposes, the normal sewer flow shall be utilized and the discharge valve closed as directed by the Contracting Officer. If, during the tests, any defects are disclosed due to poor workmanship or failure by the Contractor to comply with the specifications, the equipment shall be shut down and the Contractor shall correct defects, after which the full eight-hour test shall be rerun. If it is necessary to shut down the equipment before the eight-hour test is completed due to defective equipment, through no fault of the Contractor, the Contractor will be relieved of any further testing of the piece of equipment, provided the equipment has been run for a sufficient length of time to prove that the equipment was properly installed.

d. The Government will furnish all fuel and lubricants necessary to place the equipment furnished by the Government in operation and to properly test them. If the test must be rerun due to a faulty installation or non-compliance with these specifications, the fuel and lubricants for further testing shall be furnished by the Contractor at no additional expense to the Government.

e. After tests have been performed on the equipment, the Contractor shall retighten all anchor bolts.

f. All engines, gear units, pumps, valves, piping, except for metal surfaces finished at the factory, brass and copper pipe and fittings, shall be painted in accordance with the applicable provisions of Section XVIII.

TP17-8. PAYMENT. - a. Payment for installing the equipment furnished by the Government will be made at the contract price for Item 45, "Installing Equipment Furnished by the Government", and shall include all costs of unloading and hauling from the point of delivery, storing, handling, erecting, cleaning, placing, painting, testing, maintaining the equipment until final acceptance of the work by the Contracting Officer, furnishing and installing gasoline engine exhaust pipe assemblies and exhaust pipe insulation, doweling pumps, gears, and steady bearing; furnishing and installing exhaust pipe and silencer supports and hangers, installing battery trays and furnishing necessary shields and anchors. The cost of all electricity incidental to installing, testing and adjusting the equipment furnished by the Government shall be included in Item 45.

b. The concrete bases for pumps, gears, engines and the supports for the valves and piping will be paid for at the contract unit price for Item 24, "Concrete - Class 'A'" and shall include all grouting. Steel dowels and reinforcement in the machinery bases will be paid for under Item 26, "Steel Reinforcement".

c. All anchor bolts, sleeves and washers for equipment furnished by the Government will be paid for at the contract unit price for Item 30, "Miscellaneous Pipe and Fittings" (see Paragraph TP8-5 b).

PART IV

SECTION XVIII. PAINTING

TP18-1. WORK INCLUDED. - The Contractor shall perform all work in connection with painting and finishing work as herein specified. The work includes the priming, painting, and finishing of all exterior and interior woodwork, exterior and interior stone and brick, plaster, concrete, and metal surfaces, except bronze, brass or plated work or equipment for which a finish has been elsewhere specified. Due precautions shall be taken with reference to health regulations of the locality.

TP18-2. MATERIALS. - Materials of all kinds shall be similar and equal to brands specified or shall conform to the Federal Specifications listed:

a. White lead. - Federal Specification TT-W-251b.

b. Red lead. - Federal Specification TT-R-191a.

c. Turpentine. - Federal Specifications LLL-T-791b or LLL-T-792a.

d. Linseed oil. - Federal Specifications JJJ-O-331 and JJJ-O-336.

e. Putty. - Federal Specification TT-P-791a.

f. Shellac. - Pure white, 5-pound cut.

g. Plaster primer. - Federal Specification TT-P-56.

h. Drier. - Federal Specification TT-D-651a.

i. Thinner. - Federal Specification TT-T-291.

j. Ready-mixed paint. - Cabot Collopakes, Sherwin-Williams Co., Barreled Sunlight.

k. Varnish. - Pratt & Lambert Co., Murphy Varnish Co., Sherwin-Williams Co., U. S. Gutta Percha Paint Co.

l. Metal enamel. - Berry Brothers, Wadworth Howland Co., J. Robert Thomas.

m. Machine enamel. - Rice's Oil-proof Machine Enamel, Sherwin-Williams "Kem-Lustral".

n. Brick paint. - Cabot's "Old Virginia" white.

o. Black asphaltum. - Glidden "Smoke-stack" black, Pittsburgh "Utility" asphaltum.

p. Iron oxide paint. - Federal Specification TT-P-31a, Type B.

q. Zinc dust-zinc oxide primer. - Federal Specification TT-P-641.

r. Zinc-chromate primer. - U. S. Navy Specification 52-P-18.

s. Masonry paint. - U. S. Gutta Percha Paint Co. "Outside Barreled Sunlight Granolith" reduced with "Rice's No. 65" reducing oil as per manufacturer's recommendations.

t. Graphite paint. - Detroit Graphite Co. "Iron-Gard" Black No. 827, or equal.

TP18-3. SAMPLES. - The Contractor shall submit to the Contracting Officer, for approval, panel samples of each color and kind of paint he proposes to use in the work. Samples shall be minimum 12" x 12" panels showing textures and colors of the various finishes, and on materials on which finishes are to be applied. The Contractor shall also submit one pint, in unopened container, of each kind of ready-mixed paint he proposes to use.

TP18-4. APPROVAL OF MATERIALS. - All materials shall be delivered to the work in the manufacturer's sealed packages, with labels intact and the seals unbroken. All materials shall be subject to tests as required by the Contracting Officer. Before delivery of any material to the site, the Contractor shall submit to the Contracting Officer the names of the manufacturers and the brands and qualities of the materials he proposes to use. Only materials which have been approved by the Contracting Officer may be delivered to the work.

TP18-5. STORAGE AND PROTECTION. - Extreme caution shall be used in storing of paint in large quantities in the building. Strict measures shall be taken to provide adequate means for fire prevention and protection. The Contractor shall take particular care to protect adjoining surfaces, fixtures, and materials of all kinds, and shall be held responsible for and shall repair any damage. In cases where procedure is not definitely specified, it shall be in accordance with the best practice of the trade and as approved by the Contracting Officer. At the end of each day, the Contractor shall place in covered metal containers, or destroy, all cloths, waste, etc., which have been used in preparation and application of inflammable paint materials.

TP18-6. WORKMANSHIP. - a. General. - All work shall be of the best, with all materials evenly spread, smoothly flowed on and free from runs, drips, sagging, or brushmarks. Woodwork shall be clean, smooth, and dry before applying any paint or stain. Knots and sap wood to be painted shall receive a thin coat of shellac before priming.

(2) Masonry surfaces. - Surfaces of the end and rear walls of the porch and interior exposed brownstone ashlar and all exposed common brick shall be sealed with Barreled Sunlight Granolith, or equal, reduced with one quart of Rice's No. 65, or equal, reducing oil to each gallon of paint and then to the proper application consistency with turpentine. All surfaces shall be washed down with zinc sulphate solution (2 pounds of zinc sulphate crystals to the gallon of water) allowed to dry out thoroughly, primed and given two coats of paint. Porch ceiling shall receive the same finish.

(3) Exterior metal surfaces. - All exterior ornamental steel and wrought iron, metal work, other than bronze, copper and lead, shall be finished with two coats of approved flat finish black paint, in addition to the shop and field prime coats.

(4) Painting steel. - (a) All ungalvanized structural and miscellaneous steel work not to be encased in concrete shall be given one shop coat and one field coat of zinc-chromate primer. After the shop fabrication has been completed and accepted, all material shall be cleaned of rust, loose scale, dirt, oil, grease, and other foreign substances, by wiping with gasoline or benzene, or by other approved means. After cleaning, the steel shall be given one shop coat of zinc-chromate primer. Surfaces which will not be accessible after assembly, but not in contact in riveted connections, shall be given a second shop coat.

(b) After erection the steel shall be touched up by painting over all spots where the shop coat has been scratched, knocked off, or otherwise damaged. After touching up, the steel shall then be given a field coat of zinc-chromate primer. Either the shop coat or field coat shall contain a small amount of lamp black so that the field coat may be readily distinguished from the shop coat.

(c) Steel above the engine-room floor shall be given one finish coat of gray paint (see subparagraph (5) (a) below). Finish painting of steel below the engine-room floor shall consist of one coat of an approved blue lead enamel.

(d) All steel sash shall be given two finish coats of approved exterior enamel paint on all exterior surfaces.

(5) Painting of equipment. - (a) The equipment furnished by the Government will be painted by the equipment manufacturer. After installation, the Contractor shall touch up all damaged painted surfaces and paint one field coat on all equipment above and below the engine-room floor, with the same type and color of paint as originally used by the equipment manufacturer (see Paragraph TP17-7 f).

(b) All unfinished iron and steel parts of the equipment, furnished by the Contractor, shall be given one shop priming coat, one field touch-up priming coat, one coat of filler, and two finish coats of paint similar and equal to "Kem-Lustral, Dado Gray -

Surfaces of steel and iron shall be thoroughly cleaned of scale, dirt, and rust, using steel scrapers, wire brushes, sand blast, or other tools or suitable methods; oil and grease shall be removed with benzene. The painted and varnished surfaces shall be sand-papered, rubbed and finished, as herein specified, with surfaces left smooth and even, and free from all defects. No coat of paint or varnish shall be applied until the preceding coat is perfectly dry and hard, and no paint or varnish shall be applied in damp weather.

b. Priming. - All door and window frames, wood sash and sills, and screen frames shall be completely primed or filled. The unexposed backs and edges of all woodwork which come in contact with plaster or masonry shall be primed before installation. No priming shall be done on damp or wet surfaces. The prime coat on iron and steel shall be zinc chromate primer and on wood, not to be stained, shall be white lead and oil.

c. Puttying. - All nail holes, etc., in woodwork, all screws and holes in steel and iron work, pitting in equipment castings, and other locations where a complete finish will be required, shall be putty-stopped after priming or filling. The putty shall be colored to match the stain or paint.

d. Finish coats. - (1) Exterior wood work. - All exterior wood work including sash, sash frames, and window screen frames, except half timber, oak doors and their frames, shall receive two coats of lead and oil paint in addition to the prime coat. Colors shall be as selected by the Contracting Officer. Paint shall be mixed in approximately the following proportions:

(a) Prime or first coats:

White lead paste	100 pounds
Raw linseed oil	4 gallons
Turpentine	2-1/4 gallons
Dryer	1 pint

(b) Second coat:

White lead	100 pounds
Raw linseed oil	1-3/4 gallons
Turpentine	1-1/4 gallons
Dryer	1/2 pint

(c) Final coat:

White lead	100 pounds
Raw linseed oil	3-1/4 gallons
Turpentine	1/4 gallon
Dryer	1 pint

205", or Rice's Oil-proof Machine Enamel. The sluice gates and hoists shall be painted with two coats of black graphite paint over the prime coats (see Paragraph TP10-16).

(c) Upon completion, the painted surfaces of the equipment shall be tough and durable, and free from all pitting, blemishes and surface imperfections.

(6) Painting pipe. - All exposed pipe, valves, fittings, and exposed electrical conduit shall be given one prime coat and two finish coats of approved paint. Galvanized pipe and conduit shall be treated with Sherwin Williams "Galvo-Prep", or equal, wiped clean, and primed with zinc dust-zinc oxide. All other pipe shall be primed with zinc-chromate primer. Cast iron soil and waste piping shall be finished with black asphaltum paint. Pipe insulation, including the insulation on exhaust piping and silencers shall be sized with two coats of shellac and painted with lead and oil paint. Piping, generally, shall have a finish coat of "Kem-Lustral, Dado Gray - No. 205" and the piping for various uses, as listed below, shall have colored arrows, indicating the direction of flow, clearly stenciled on the pipe, in accordance with the color code described below, at intervals and adjacent to valves and fittings. There shall be two types of arrows, thus: (1) plain (——→) and (2) dotted (•——→). The Contractor shall install in the engine room a color chart, in a glazed frame, showing the color code, which shall be as follows:

Use of pipe	Color of arrow	Type of arrow
Cold water (domestic)	blue	plain
Hot water	red	dotted
Engine cooling water	yellow	dotted
Engine cooling water drains	white	plain
CO_2 lines	red	plain
Gasoline supply lines	orange	plain
Gasoline return lines	green	plain
Diesel fuel line	blue	dotted
Oil burner fuel line	yellow	plain
Hydraulic valve water lines	green	dotted
Hydraulic valve waste lines	orange	dotted

(7) Painting bar screens and tanks. - (a) Those portions of the bar screens that are not encased in concrete shall be thoroughly cleaned and given one field coat of zinc chromate primer after installation. The finish painting shall consist of two coats of black graphite paint (see Paragraph TP9-15).

(b) The gasoline and oil tanks shall be painted in the shop with one coat of zinc chromate primer and two coats of black graphite paint as specified in Paragraph TP10-16 for sluice gates. After installation, any spots on the tanks where the paint has been damaged shall be touched up with graphite paint.

(8) Painting concrete. - The concrete strip of trench curb in the store room shall be painted with two coats of an approved lead and oil paint. Before painting, the concrete shall be thoroughly cleaned of all dirt, oil, grease, and other foreign material by scrubbing with soap suds and flushing with clean, warm water. After washing, the concrete shall be treated with a weak solution of muriatic acid and again flushed with clean water. The concrete shall then be allowed to become thoroughly dry before painting. No paint shall be applied to concrete for at least 30 days after the concrete is placed.

(9) Interior woodwork. - All woodwork shall be sanded smooth, thoroughly cleaned and dry. Nail holes, cuts, cracks, etc., shall be treated so as to appear unnoticeable. All wood, except wood handrails, toilet stall doors and other items specifically excepted, shall receive a priming coat of enamel undercoat and two coats of semi-gloss, prepared and mixed for each coat in accordance with the manufacturer's recommendations. Each coat shall be well brushed in and the last coat flowed on. Each coat shall be well sanded before the ensuing coat is applied.

(10) Wood doors. - Both sides of exterior wood doors, including toilet stall doors, and frames and the wood hand-rail of stairs, shall receive a coat of stain, filled with paste wood filler, and three coats of spar varnish applied with a rubbed finish. Undercoats shall be rubbed with steel wool and the last coat rubbed with pumice and oil.

(11) Half timber work shall be finished to give a weathered effect. It shall be given two coats of linseed oil, allowing the first coat seven days of clear weather to dry before applying the second coat.

(12) Interior metal work. - All interior metal work, louvers, registers, steel stairs and railings, metal doors, steel sash, trim and frames, other than brass, lead, or copper, shall be painted with two coats, in addition to the prime coat, of interior metal enamel in light colors selected by the Contracting Officer.

(13) Plaster walls and ceilings shall be thoroughly cleaned, spackled, and sized, and painted two coats of semi-gloss paint. Each coat shall be tinted in a different shade before applying. All colors for plastered walls and ceilings shall be in solid tones as selected by the Contracting Officer.

(14) Large store room. - The wood trusses in the large store room shall receive two coats of linseed oil as directed. The soffit of the roof plank and the purlins shall receive a prime coat and two coats of semi-gloss paint. Colors shall be as selected by the Contracting Officer.

e. Paint application. - Surfaces to be painted shall be clean, dry, smooth and free from dust and frost. The moisture content of wood shall not exceed 19 per cent at the time paint is applied. Where wood is not sufficiently seasoned, painting shall be deferred until the lumber has dried to the degree specified. No paint shall be applied when the temperature is below 40 degrees Fahrenheit. After priming, nail holes shall be putty stopped. Sufficient time shall be allowed between coats of paint to insure drying. Under average conditions, about 7 days of clear weather will be required for this purpose. All work shall be done in a workmanlike manner, leaving finish surfaces free from runs and sags.

f. Cleaning up. - Upon completion of the work, the Contractor shall remove all spots, stains, etc., from glass, hardware, floors and other surfaces not to be painted. All staging, scaffolding, debris, containers, etc., shall be removed and the premises left in a clean condition to the satisfaction of the Contracting Officer.

TP18-7. PAYMENT. - No separate payment will be made to the Contractor for painting. Payment for paint and painting shall be included in the contract prices for the various items to which the work pertains.

SECTION XIX. MISCELLANEOUS
(Items 46 to 49 inclusive)

TP19-1. GRADING (Item 46). - a. Work included. - The Contractor shall perform general over-all grading, not covered in other items of the work, to the lines, grades, and limits shown on the drawings and herein specified.

b. Description. - The surfaces to be graded shall be excavated or filled to the elevations and slopes indicated on the drawings. Additional fill, if of approved quality, may be obtained from existing excavations or from approved borrow areas. All surplus or undesirable excavated material shall be disposed of in spoil areas as directed by the Contracting Officer.

c. Placing. - The provisions of Paragraph TP5-3 c shall apply.

d. Measurement and payment. - Measurement will be made by the square yard for the area graded as specified and directed. The measurement will be the actual superficial areas of grading performed to lines and limits indicated on the drawings or as directed by the Contracting Officer. Payment will be made at the contract unit price for Item 46, "Grading".

TP19-2. TOPSOIL (Item 47). - a. Work included. - The Contractor shall place topsoil in the locations and to the compacted thickness of 6 inches shown on the drawings or as required by the Contracting Officer.

b. Materials. - (1) Topsoil shall consist of fertile, friable, natural topsoil, typical of that in the locality of the project, as approved by the Contracting Officer. It shall be reasonably free from stumps, roots, hard lumps, stones greater than 1 inch in diameter, noxious weeds, sticks or other litter. It shall contain from 4 to 12 per cent organic matter by weight, determined as loss on ignition of oven-dried samples. Prior to stripping, the topsoil shall have demonstrated its suitability by the occurrence upon it of health crops, grass or other vegetative growth.

(2) Topsoil shall be obtained from approved stored materials slavaged from stripping and required excavations, from approved borrow areas on the site, or shall be furnished by the Contractor from other approved sources at least two weeks in advance of contemplated use and the Contractor shall assist in obtaining samples. If, after testing of the samples, the topsoil is found unsatisfactory, the material will be rejected unless the Contractor agrees to apply additional soil amendments and fertilizer of the type and amount needed to make the proposed topsoil suitable, at no additional cost to the Government.

c. Placing topsoil. - After the general excavation, fill and grading have been completed to the required height and dimensions, the Contractor shall apply the stored topsoil, or additional acceptable topsoil if necessary, from a source approved by the Contracting Officer to the specified depth when compacted, over the required areas to the limits shown on the drawings or as directed. On areas which are intended to receive topsoil, the compacted subgrade shall be scarified to a depth of 2 inches for the bonding of topsoil with subsoil. Topsoil is then to be evenly spread, compacted and graded to the thickness and to the elevations and slopes shown on the drawings, or as directed by the Contracting Officer. The topsoil shall be lightly rolled or tamped, and any unevenness of surface shall be corrected to conform to finished grades.

d. Measurement and payment. - Measurement will be made by the cubic yard for the amount of topsoil actually placed in accordance with directions, whether obtained from stockpiles or from other sources, and measured in place after compacting. Payment shall include the costs for furnishing and placing the topsoil. Payment for topsoil will be made at the contract unit price for Item 47, "Topsoil."

TP19-3. INSULATING 6-INCH WATER MAIN. (Item 48). - a. Work included. - The Contractor shall insulate the existing underground 6-inch water main as herein specified or as directed. Excavation and back fill incidental to this operation shall be included in this item of the work.

b. Description. - The 6-inch underground water main shall be insulated with a 3-layer, hair felt insulation. Each layer shall be one inch thick and secured to the pipe with heavy jute twine on 2-inch centers and over the outer layer shall be applied a layer of 15-pound asphalt felt, secured in place with a wrapping of jute twine. The insulation shall be jacketed with an asphalt-saturated felt, held in place by means of rings of No. 16 gage copper wire on 4-inch centers. Materials shall be similar and equal to Built-up Hair Felt Pipe Insulation and Double-Coated Flexstone as manufactured by Johns-Manville Co.

c. Payment. - Payment will be made at the contract unit price for Item 48, "Insulating 6-inch Water Main".

TP19-4. BITUMINOUS MACADAM PAVEMENT (Item 49). - a. Work included. - The Contractor shall construct the bituminous macadam pavement of the specified quality required for roads as shown on the drawings and as herein specified. The work under this item shall also include the removal of granite curbing at the intersection of the access roadway and Elm Street and stockpiling the curbing for later removal by the City of Hartford.

b. Description. - The pavement shall consist of a one-course wearing surface, of 2-1/2-inch compacted thickness, composed of crushed stone and bound with keystone and bituminous material, and a bituminous seal coat and peastone covering. The pavement shall be

constructed, on a previously prepared base course, by the penetration method, in accordance with these specifications and in conformity with the lines, grades, and typical cross sections shown on the drawings.

c. Base preparation. - The base, having been constructed previously, shall be maintained in acceptable condition during placement of the macadam wearing surface and any damaged areas of the base shall be repaired to the satisfaction of the Contracting Officer.

d. Materials. - (1) Crushed stone shall consist of clean, hard, tough, and durable fragments of rock of uniform quality throughout. The crushed stone shall be free from soft disintegrated pieces, dirt, crusher dust, and organic or other objectionable matter. Coarse aggregate of a size retained on a 1-inch square mesh sieve shall not contain more than 5 per cent of flat or elongated pieces whose length exceeds three times their least dimensions. When tested by means of the Los Angeles Rattler (A.A.S.H.O. T96-38) the crushed stone shall show a loss on abrasion not to exceed 25 per cent at 500 revolutions:

(2) Coarse aggregate shall conform to the following gradation:

Square Mesh Sieve	Total passing Per cent by weight
2-1/2-inch Screen	100
2-1/4-inch Screen	95 - 100
2-inch Screen	70 - 95
1-1/2-inch Screen	20 - 50
1-1/4-inch Screen	0 - 15
1-inch Screen	0 - 5

(3) Key stone used for binding or choking the coarse aggregate shall conform to the following gradation:

Square Mesh Sieve	Total passing Per cent by weight
1-inch Screen	100
3/4-inch Screen	95 - 100
1/2-inch Screen	30 - 70
3/8-inch Screen	0 - 20
4 meshes per inch	0 - 5

(4) Pea stone used for sealing the surface of the pavement shall conform to the following gradation:

Square Mesh Sieve	Total passing Per cent by weight
3/4-inch Screen	100
1/2-inch Screen	95 - 100
3/8-inch Screen	30 - 70
4 meshes per inch	0 - 20
8 meshes per inch	0 - 5

(5) Bituminous material. - Bituminous material shall be asphalt cement, conforming to Federal Specification SS-A-706b, of 85 - 100 penetration and applied at temperature of 275 degrees to 350 degrees Fahrenheit.

e. Equipment. - (1) Rollers shall be three-wheeled, self-propelled, smooth-wheeled, weighing not less than 10 tons, equipped with a water spraying device or other approved equipment to prevent bitumen from sticking to the wheels. Rollers shall be in good mechanical condition and shall not drip oil, gasoline, or other foreign substances on the road surface.

(2) Pressure distributors shall be of an approved type, equipped with pneumatic tires, capable of spraying satisfactorily, if required, for a width of not less than 15 feet at a pressure between 40 and 70 pounds per square inch. They shall be equipped with a system for heating the bituminous material that insures the even heating of the entire mass of material under efficient and positive control at all times. Distributors shall also be equipped with satisfactory thermometers for measuring the temperature of the material to be applied and shall have either a steam or air-kerosene system for the clearing of the lines and pumps. Evidence of fluxing with kerosene or emulsification by steam will be sufficient cause for rejection of the delivery. Distributors shall be capable of spreading the bitumen uniformly, shall not leak, and must be in good mechanical condition. The distributors shall also be equipped with accurate tachometers approved by the Contracting Officer. Deliveries of bitumen will be refused when the above conditions are not fulfilled.

(3) Hose attachments to the distributor and slotted spout hand pouring pots shall be used to apply bitumen wherever necessary to touch up all spots unavoidably missed by the distributor.

f. Spreading and compacting coarse aggregate. - (1) On the freshly cleaned and swept base course, coarse aggregate shall be spread in an approved manner to prevent segregation of sizes, forming a uniformly, loose layer to conform with the specified grades and thicknesses when compacted. The aggregate shall then be dry-rolled until the stone is thoroughly compacted and keyed together to form a firm even surface, true to grade and cross sections given.

(2) The rolling shall begin with outer edges of the surfaces and shall progress gradually toward the center lapping uniformly each preceding rear wheel track by one-half the width of such track. The rolling shall continue until the entire area of the pavement has been rolled by the rear wheels and become thoroughly keyed, and creeping of stone ahead of the roller no longer visible. Any portion of the pavement not accessible to rollers shall be thoroughly compacted by mechanical or hand tamping. Hand tampers shall weight not less than 50 pounds and have a face area of not more than 100 square inches.

(3) The compacted coarse aggregate shall then be examined to insure that it possesses a firm even surface, true to the required grades and cross section, and presents a texture which will allow a uniform penetration of the bituminous material. If any irregularities in surface grades or texture appear during or after rolling, such shall be promptly remedied by reconstruction as directed by the Contracting Officer. All coarse aggregate which becomes coated or mixed with dirt or foreign substances prior to penetration with bituminous material shall be removed, replaced with clean aggregate, and recompacted. Concentrations of fine or undersize aggregate or flat or oversize aggregate appearing on the surface shall be removed.

g. Application of bituminous material. - (1) Hot bituminous material shall be applied uniformly over the surface of the compacted coarse aggregate, by approved pressure distributors at the rate of 1-1/2 to 1-3/4 gallons per square yard. The bituminous material shall be applied only when the crushed stone is thoroughly dry, when the weather is not foggy or rainy, and when the air temperature in the shade is 50 degrees Fahrenheit or above, unless otherwise directed by the Contracting Officer.

(2) The Contractor shall, in order to insure uniformity at the junction of two applications of bituminous material, employ methods acceptable to the Contracting Officer so that penetration is accomplished at the full force of the sprayers on both sides of each junction point. The method used shall eliminate gaps and overlapping between applications. Similar methods or building paper shall be used to prevent overlapping of the bituminous material at longitudinal and other joints. Building paper if used for this purpose, shall be removed and burned.

(3) The Contractor shall cover the surface of curbs, edgings, walls, walks, or adjacent surfaces satisfactorily to prevent coating them with bituminous material and shall remove any bitumen that may have adhered to the surfaces in spite of such protective measures.

h. Application of key stone. - Immediately after applying the penetration coat of bituminous material, and while it is still warm, clean, dry key stone shall be spread longitudinally over the surface in such quantity that will completely fill the voids in the coarse aggregate. The key stone shall be spread in an approved manner. The surface shall then be rolled and broomed until the key stone is thoroughly bonded with the bituminous binder and until the surface is well compacted and uniform in appearance.

i. Application of seal coat. - (1) All excess key stone shall be removed and the surface swept clean. A coating of bituminous material at temperature specified shall then be applied uniformly at the rate of between 1/2 and 3/4 gallon per square yard of surface (see subparagraph TP20-4 e). After the seal coat has been spread it shall be covered immediately with clean, dry pea stone applied longitudinally in just sufficient quantity to blot up the bituminous

material. The entire surface shall then be broomed and rolled as directed by the Contracting Officer.

(2) During the period between the initial compaction of the coarse aggregate and completion of the seal coat, the surface course shall be protected from all traffic other than that absolutely essential to its construction.

j. Part-width construction. - When the surface is constructed only for part of the width, the first width of stone shall be spread and rolled not less than two feet wider than the bituminous application. The rolling of the adjoining width shall overlap the first and be conducted to leave a smooth and uniform joint. The applications of bituminous material, key stone, and seal coat aggregate at the junction shall be carefully regulated to avoid excess or deficiencies in bituminous material and to create a uniform surface.

k. Surface tolerances. - After completion, the surface shall be tested with a 10-foot straight edge in both directions. The surface of the finished pavement shall be free from irregularities exceeding 3/8 inch in 10 feet.

l. Curbing. - Existing curbing at the intersection of the access driveway and Elm Street shall be removed as shown on the drawings. Removed curbing shall be carefully stockpiled for later removal by the City of Hartford.

m. Measurement and payment. - Measurement will be made by the square yard for the area of bituminous macadam satisfactorily constructed. Payment will be made at the contract unit price for Item 49, "Bituminous Macadam Pavement". Payment under Item 49 shall also include all cost of removing and stockpiling curbing.

SECTION XX. REINSTALLATION OF PUMP EQUIPMENT IN THE NORTH MEADOWS PUMPING STATION (Items 50 and 51)

TP20-1. WORK INCLUDED. - a. Equipment from the temporary Keeney Lane Pumping Station. - The Contractor shall install the pumping equipment listed below, including accessories, in the North Meadows Pumping Station as herein specified and as directed by the Contracting Officer. This equipment will be removed from the temporary Keeney Lane Pumping Station and stored on the engine room floor of the North Meadows Pumping Station by others.

(1) One 36-inch volute pump with suction elbow and sole plates.

(2) Two 36-inch gate valves.

(3) One 36-inch check valve.

(4) One 300-horsepower gasoline engine with battery.

(5) One 300-horsepower right-angle gear unit with vertical shafting.

(6) One flexible exhaust connection and silencer.

b. Existing pump engine in the North Meadows Pumping Station. - The Contractor shall remove the existing pump engine in the North Meadows Pumping Station from its base and place it on timber supports adjacent to the base, and after repairs to the coupling by others, the Contractor shall reinstall the engine.

c. Equipment in the temporary Bushnell Park Pumping Station. - The Contractor shall remove the pumping equipment, consisting of the items of equipment listed below, from the existing temporary pumping station at Bushnell Park, and shall deliver and install the equipment in the North Meadows Pumping Station as herein specified and as directed by the Contracting Officer.

(1) One 36-inch volute pump with suction elbow and sole plates.

(2) Two 36-inch gate valves.

(3) One 36-inch check valve.

(4) One 300-horsepower gasoline engine with battery.

(5) One 300-horsepower right-angle gear unit with vertical shafting.

(6) One flexible exhaust connection and silencer.

TP20-2. GENERAL. - a. The equipment included in subparagraphs TP20-1a and c was originally installed in the North Meadows Pumping Station, and was removed to provide pumping capacity in the temporary stations.

b. The temporary Bushnell Park Pumping Station is located in Bushnell Park in the City of Hartford, Connecticut, adjacent to the north side of the Park River Conduit and west of Hudson Street.

c. The North Meadows Pumping Station is located on the west bank of the Connecticut River in the north portion of the City of Hartford, approximately two miles from the temporary Bushnell Park Pumping Station.

d. Subject to the approval of the Contracting Officer, methods of removal and transportation of equipment will be the responsibility of the Contractor. Materials or equipment lost, broken or damaged in removing, transporting or installing shall be replaced by the Contractor to the satisfaction of the Contracting Officer, at no additional expense to the Government.

TP20-3. PROCEDURE. - The work shall be performed according to the following order of procedure.

a. Installation of pumping equipment listed in Paragraph TP20-1a. This equipment will be available within one hundred (100) calendar days after the date of receipt by him of notice to proceed, and the installation shall be completed within one hundred and sixty (160) calendar days after the date of receipt by him of the notice to proceed.

b. Removal of existing pump engine in the North Meadows Pumping Station from its base, placing the same on timber supports adjacent to its concrete base, and after repairs to the coupling by others, reinstall the engine. Work on this engine shall not be commenced until the provisions of subparagraph a above have been completed. Reinstallation shall be completed within sixty (60) calendar days after the completion of the installation of the equipment as specified in subparagraph a above.

c. Removal of the pumping equipment from the temporary Bushnell Park Pumping Station and reinstalling the same in the North Meadows Pumping Station, except the gasoline engine which shall be installed at a later date. The pumping equipment in the temporary Bushnell Park Pumping Station shall not be removed until written permission has been obtained from the Contracting Officer. This permission will not be given until after the new pumping equipment is installed and ready for operation in the pumping station to be constructed under this contract.

TP20-4. REINSTALLATION AND TESTING OF EQUIPMENT. - a. Pumping Equipment from Temporary Keeney Lane Pumping Station. - The pumping equipment specified in Paragraph TP20-1a shall be installed in final position. One coupling shall be removed from the intermediate shaft. The shaft shall then be cut to fit the North Meadows Pumping Station, a keyway cut in the shaft and the coupling reinstalled on the shaft by a press. Existing grout shall be removed entirely from equipment bases. It may

be necessary to loosen the top of anchor bolts in the concrete bases to secure the desired alignment. The maximum misalignment of the flexible couplings shall not exceed .005 inch in either the angular or parallel direction. After the equipment has been set to the satisfaction of the Contracting Officer, the equipment shall be grouted with a non-shrinking cement mortar similar and equal to "Embeco" cement, as manufactured by the Master Builders Co. of Cleveland, Ohio. The grout shall be worked beneath all parts of the base. When the grout has attained its initial set, the exposed surface of the grout shall be rubbed to a smooth finish. The Contractor shall make all connections for cooling water, gasoline, waste water, battery-charging circuit, engine exhaust and fire extinguishing system. All connections shall be tested and proven tight. The Contractor shall operate this equipment for a sufficient length of time to ascertain that all the equipment is in good working condition. In the event the operation of the equipment discloses any defects due to faulty or improper installation, said defects shall be corrected by the Contractor to the satisfaction of the Contracting Officer, at no additional expense to the Government.

b. Existing North Meadows Pumping Station Pumping Equipment. - The existing pump engine shall be removed from its base, placed on timber supports and shall remain in this position for thirty (30) calendar days (time required for the replacement, by others, of the existing flexible coupling by a Morse "Silent Chain" coupling). After the coupling has been replaced and permission in writing from the Contracting Officer has been obtained, the Contractor shall reinstall the engine. Reinstallation and testing shall conform to the applicable provisions of subparagraph a above.

TP20-5. PAYMENT. - a. Payment for installing and testing the pumping equipment from the temporary Keeney Lane Pumping Station and for removing, transporting, installing and testing the pumping equipment from the temporary Bushnell Park Pumping Station in the North Meadows Pumping Station will be made at the contract price for Item 50, "Removing, Transporting and Installing Pump Equipment".

b. Payment for removing and reinstalling the existing pump engine at the North Meadows Pumping Station will be made at the contract price for Item 51, "Demounting and Remounting Pump Engine."

Bid No.
Serial No. 19-016-47-90

BID
(CONSTRUCTION CONTRACT)

Date:

To: The Division Engineer
New England Division
Corps of Engineers
War Department
31 St. James Avenue
Boston 16, Mass.

Project: CONSTRUCTION OF BUSHNELL PARK PUMPING STATION, HARTFORD, CONNECTICUT

In compliance with your invitation for bids dated 14 May 1947, the undersigned hereby proposes to furnish all plant, labor, materials and equipment, except materials or equipment specified herein to be furnished by the Government, and perform all work for the above-described project in strict accordance with the specifications, schedules, drawings, and addenda numbered -

for the consideration of the following prices:

Item No.	Estimated Quantities	Unit	Description	Unit Price	Estimated Amount
1	-	job	Preparation of Site		
2	-	job	Control of Water and Sewage		
3	6,400	cu.yd.	Common Excavation - General		
4	130	cu.yd.	Common Excavation - Trench		
5	680	cu.yd.	Rock Excavation		
6	-	job	Removing Existing Concrete		
7	-	job	Removing 48-inch Reinforced Concrete Pipe		
8	-	job	Removing Existing Pumping Station Superstructure		
9	350	cu.yd.	Pit-run Gravel		
10	700	cu.yd.	Compacted Backfill		

Item	Estimated Quantities	Unit	Description	Unit Price	Estimated Amount
11	1,800	cu.yd.	Semi-compacted Backfill		
12	120	lin.ft.	Vitrified Clay Pipe, 4-inch		
13	80	lin.ft.	Vitrified Clay Pipe, 8-inch		
14	145	lin.ft.	Vitrified Clay Pipe, 12-inch		
15	100	lin.ft.	Vitrified Clay Pipe, 12-inch, Remove and Reset		
16	-	job	Reinforced Concrete Pipe, 24-inch, Remove and Reset		
17	100	lin.ft.	Cast Iron Pipe, 4-inch		
18	210	lin.ft.	Cast Iron Pipe, 6-inch		
19	3	each	Brick Manholes, 5'-0" Deep		
20	17	lin.ft.	Brick Manholes, Each Additional Foot of Depth in Excess of 5'-0"		
21	-	job	Remodeling Existing Manholes		
22	4	each	Concrete Catch Basins		
23	1,740	bbl.	Portland Cement		
24	890	cu.yd.	Concrete		
25	460	cu.yd.	Concrete		
26	189,000	lb.	Steel Reinforcement		
26A	9,900	sq.ft.	Absorptive Form Lining		
27	-	job	Superstructure		
28	190	lin.ft.	Brownstone Wall		
29	22,000	lb.	Miscellaneous Metal		
30	1,850	lb.	Miscellaneous Pipe and Fittings		
31	2	each	Mechanically Cleaned Bar Screens		

Item	Estimated Quantities	Unit	Description	Unit Price	Estimated Amount
32	3	each	Sluice Gates, Complete with Hoists		
33	-	job	Salvage and Reinstallation of Existing 84" by 84" Sluice Gate and Hoist		
34	-	job	Heating and Ventilating		
35	-	job	Electric Light and Power System		
36	-	job	Gasoline-Electric Standby Unit		
37	-	job	Traveling Crane, Complete		
38	-	job	Water Supply and Plumbing		
39	-	job	Carbon Dioxide Fire Extinguishing Equipment		
40	-	job	Sump Pump		
41	-	job	Gasoline Tank and Piping		
42	-	job	Diesel Fuel Tank and Piping		
43	-	job	Float Gage		
44	-	job	Rubbish Hoist and Sidewalk Doors		
45	-	job	Installing Equipment Furnished by the Government		
46	3,130	sq.yd.	Grading		
47	335	cu.yd.	Topsoil		
48	-	job	Insulating 6-inch Water Main		
49	675	sq.yd.	Bituminous Macadam Pavement		
50	-	job	Removing, Transporting and Installing Pump Equipment		
51	-	job	Demounting and Remounting Pump Engine		
			TOTAL		

PLANT AND EQUIPMENT SCHEDULE

Available Plant To Be Used

Excavating Equipment

No.	Type	Capacity	Manufacturer	Age & Condition	Location

Concreting Equipment

No.	Type	Capacity	Manufacturer	Age & Condition	Location

Miscellaneous Equipment

No.	Type	Capacity	Manufacturer	Age & Condition	Location

The items of equipment that the bidder proposes to furnish and install in the work, and of which descriptions are required herein, are described on the following data sheets. The bidder agrees that the statements concerning these items made herein are express warranties, and further agrees that the award of this contract shall not be construed as a guarantee by the Government that the materials or supplies listed are approved.

DATA SHEET

MECHANICALLY CLEANED BAR SCREENS

1. Mechanically Cleaned Bar Screens

   a. Manufacturer _____

   b. Model or type _____

2. Electric motor:

   a. Manufacturer _____

   b. Type and rating _____

DATA SHEET

SLUICE GATES

1. Gates:

   Manufacturer _____

2. Hoists:

   a. Manufacturer _____

   b. Model or type _____

   c. Hoisting speed _____

3. Electric Motors:

   a. Manufacturer _____

   b. Type and rating _____

DATA SHEET

31 Kva GASOLINE-ELECTRIC GENERATOR UNIT

1. Engine: (Manufacturer)_____

   Number Cylinders_____

   Bore and Stroke_____

   Piston Speed at Rated Output_____

   Lbs. Fuel per kw-hr. at 125% Rated Output of Generator_____

   Lbs. Fuel per kw-hr. at 75% Rated Output of Generator_____

   Battery (Make and Capacity)_____

   Governor (Make and Type)_____

   Net Weights: Engine_____ pounds

   Generator and Exciter_____ pounds

   Complete Unit, including Common Base_____ pounds

2. Electric Generator: (Manufacturer)_____

   Rating:_____

   Efficiency, at 80% lagging power factor, as determined in accordance with American Institute of Electrical Engineers standardization rules, will not be less than the following:

   Full load_____%; 3/4 load_____%; 1/2 load_____%.

DATA SHEET

TRAVELING CRANE

a. Manufacturer_____

b. Capacity_____tons

c. Type_____

d. Chain pull at rated load_____

e. Chain overhauled to raise load one foot_____

DATA SHEET

SUMP PUMP

1. Pump:

   a. Manufacturer _____

   b. Model or type _____

   c. Capacity at 40-foot head at rated speed _____

   d. Shut-off head _____

   e. Pipe size of discharge connection _____

2. Electric motor:

   a. Manufacturer _____

   b. Type and rating _____

DATA SHEET

ELECTRIC SWITCHBOARD

Manufacturer_____

Type Construction_____

Overall Dimensions (Approx.)_____

The bidder agrees, upon receipt of written notice of an award of the contract within sixty (60) days after the date of opening of the bids, that he will execute W. D. Contract Form No. 2, in accordance with this bid as accepted, and if the consideration of the contract will exceed $2,000 in amount, will furnish to the Government a performance bond on U. S. Standard Form No. 25 or U. S. Standard Form No. 25-B and a payment bond on U. S. Standard Form No. 25-A or U. S. Standard Form No. 25-C with good and sufficient surety or sureties, as required by the specifications, at the time that the contract is executed.

The bidder further agrees that if awarded the contract he will commence the work within fifteen (15) calendar days after the date of receipt by him of notice to proceed, provide the plant and equipment as set forth in the PLANT AND EQUIPMENT SCHEDULE, and that he will fully complete the work ready for use not later than five hundred and fifty (550) calendar days after the date of receipt by him of notice to proceed.

It is hereby warranted that in the event award is made to the undersigned, there will be furnished under this contract, or used in the performance of the work covered by this contract, only such unmanufactured articles, materials and supplies as have been mined or produced in the United States and only such manufactured articles, materials and supplies as have been manufactured in the United States substantially all from articles, materials or supplies mined, produced or manufactured, as the case may be, in the United States, except as noted below or otherwise indicated in this bid or authorized in the invitation.

Security (bid bond - U. S. Standard Form No. 24) if required by the invitation is inclosed.

_____

By _____

_____
(Title)

_____
(Business Address)

NOTE: If the bidder is a corporation, indicate State of Incorporation under signature; and if a partnership, give full names of all partners.